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The Absurdity of Making a Political Issue of Water Power

In the recent presidential campaign Gov. Smith tried to introduce as an issue the government ownership of water power. In bolting the Republican party Senator Norris cited Gov. Smith's stand on this matter as the main reasons for his action. He said:

"For his courageous stand on this, the most important issue now confronting the American people, he (Smith) is entitled to the warmest praise and commendation, regardless of politics or of party.

"The importance of the question transcends any party consideration. Never before in the history of our country has there been such a startling disclosure of a mammoth attack at the very foundation cornerstone that supports our government fabric. Never in history has there been anything that will compare with it and regardless of politics, regardless of everything else involved in this campaign, it seems to me the people of the country must rise in defense of our liberties, in defense of our common country, and they must do it soon before we are helpless within the clutches and the control of this giant monopoly."

Although Gov. Smith advocated government ownership only of waterpower plants, it is evident that Senator Norris thought Gov. Smith included all power plants, for his denunciation of the "power monopoly" and praise of Smith can mean nothing else.

Senator Norris, like Gov. Smith, is clearly misinformed as to the value of water rights, and he is equally mistaken as to America's "helplessness within the clutches and control of this giant monopoly." Had he consulted any engineer broadly experienced in the cost of generating electric power, he would have learned that hydro-electric power has ceased to be a serious competitor of steam-electric power. Had he talked with any State Public Service Commissioner he would have learned that the "helplessness" in the clutches of power monopolies is not a fact, never has been a fact, and is, less than ever, likely to become one. Nearly every state has such a commission that controls the rates charged for electric current. So where is the alleged "helplessness" of the American public? Senator Norris talks a language about utility "trusts" that is ancient history. And it is equally ancient to speak of water power as a thing of relatively great value.

Large modern steam-electric plants are generating electricity with less than one pound of coal per kilowatt-hour. With coal at $5 a ton (of 14,000 B. T. U. coal) this means that the fuel cost is less than one-quarter cent per kilowatt-hour, or about one-fifth cent per horsepower-hour. The labor of operating such plants costs about ten per cent of the cost of the coal, bringing the cost of fuel and labor to about 0.28 ct. per K. W. H. (kilowatt-hour). Such a plant costs about $120 per kilowatt (or one and one-third horsepower), and usually operates on a load factor of about 50 per cent; but since standby equipment equal to about 25 per cent of the peak load is usually provided, to take care of repair layoffs and growth in the load, the investment is about $150 for every 4,400 K. W. H. generated annually. With a fair return rate of 8 per cent on the investment and a depreciation rate of 4 per cent, the annual cost of these fixed charges is 12 per cent of $150, or $18, which, divided by 4,400, is 0.41 ct. per K. W. H. The annual maintenance cost on such a plant may be taken at 2 per cent, which amounts to 0.07 ct. per K. W. H. Taxes seldom exceed half the maintenance in cost. Summing up we have:

	Cts. Per K. W.H.
Fuel (1 lb. per K. W. H. at $5 a ton)	0.25
Labor	0.03
Maintenance (2%)	0.07
Depreciation (4%)	0.14
Taxes (1%)	0.04
Fair return (8%)	0.27
Total	0.80

This total cost of 8 mills per kilowatt-hour is what many large steam plants are now attaining, and it is less than the fixed charges alone on the average hydro-electric power plant and its transmission line that delivers the power. Hydro-electric plants usually cost more than three times as much as steam plants of equal capacity, when the transmission lines that bring the current to the city are included, as they must be included if comparisons are to be made. Even if the hydro-electric plant had no standby capacity at all, and if it cost only 2.5 times $120 per K. W., the investment would be $300 per K.W. Then if it were assumed to have no depreciation and no operating expense other than taxes, its fixed charges of 8 per cent fair return and taxes of 1 per cent would be $27 a year, or 0.6 ct. per K. W. H. at a 50 per cent load factor.

But to assume that such a plant does not depreciate is an economic error of the first magnitude, for every invention that lowers the cost of producing power by steam lowers the value of every hydro-electric property in America. At first such a lowering of value merely decreases the value of the water rights, but where there ceases to be a water-right value (as occurs when power is generated by steam as cheaply as by water power), then the value of the hydro-electric plant begins to decrease as a result of decreasing cost of steam-generated power. In short, it is a fatal economic blunder not to estimate functional depreciation in every hydro-electric plant. The editor's experience, which has been rather broad in these matters, leads him to estimate not less than 2 per cent annual depreciation in a hydro-electric plant. This is equivalent to $6 a year per K. W. on a $300 cost, or about 0.14 ct. per K. W. H. with a 50 per cent load factor where there is no standby capacity. This makes a total of 0.74 ct. per K. W. H. for fixed charges and taxes alone, on a plant devoid of standby capacity. When operating expenses, including maintenance, are added, the total exceeds the cost of steam-generated power.

Rare indeed is the new hydro-electric project that can be built today in America for $300 per K. W., including

transmisison line. Rarer still is the project that calls for no steam standby to furnish power when the water supply of the hydro-electric plant is inadequate.

The steam engine is still susceptible of a considerable increase in efficiency, whereas hydro-electric plant efficiency has almost reached its limit. By the use of lower-priced fuels steam plants are steadily decreasing the cost of generating power, whereas hydro plants have no similar prospect of improvement. The construction cost per kilowatt of steam plants has declined much more rapidly than that of hydro-electric plants, and there is no prospect of any change in this respect.

All in all, it is very clear that new hydro-electric developments in America will grow progressively fewer and less in relative importance. Our Gov. Smiths, Ex-Gov. Pinchots, and Senator Norrises may continue for a while to beat the alarm drums, but the tumult and the shouting will soon die as "the captains and the kings depart."

Is America "Beyond the Reach of Rivalry"?

The London Morning Post, in commenting on the Rockefeller gift of a library to Cambridge University, said: "The Rockefeller Foundation hands out millions as others give their thousands; and if such vast wealth is rare, such willingness, and even determination, to bestow that wealth for impersonal and unselfish uses is hardly less rare. In that respect, America has set an example to the world—has, indeed, almost created a tradition, in which her vast resources place her beyond the reach of rivalry."

To these last dozen words we call attention. In them is the commonest European explanation of American prosperity. Yet Russia has natural resources as great as ours—vast areas of fertile soil, hills of coal and iron ore, petroleum in huge quantities and great supplies of the basic products that are to be found in these United States. But there are no Russian Rockefellers. Nor is there a prosperity comparable, even remotely, with that of England. Natural resources, therefore, do not supply a sufficient reason for American world supremacy in wealth and in income.

Universal education, "mass production," and half a score of other reasons for American success are often mentioned. Rarely is mention made of the one thing that distinguishes America most from other countries, namely industrial freedom. Yet it is perhaps the most obvious difference between America and Russia. Whereas Russians are now fettered by a system worse than any tzar ever imposed, Americans enjoy more freedom to initiate and carry on business enterprises than is to be found elsewhere.

Freedom alone does not lead to prosperity, but it is one of the essential conditions of great prosperity. Freedom from labor-union restrictions, freedom from social restrictions (such as caste), freedom from religious restrictions, freedom from laws that thwart initiative, freedom from unwise tariffs and other laws that hamper business, freedom from heavy taxation for huge standing armies or navies, freedom from socialistic "doles" and "pensions"—such are the sorts of freedom that Americans enjoy to a greater extent than any other nation.

As we write, one of the leading political parties in England is proposing an old-age pension for every one who has reached sixty-five. Unemployment and sickness "doles" are to be increased. Maternity "doles" already exist. Instead of encouraging thrift and individual initiative, laws are enacted that reward the thriftless and penalize the thrifty. All this is done in the name of justice and charity. But it is a forced charity, and the justice of it is certainly not the sort of justice that is pictured in the parable of the faithful servant.

Why States Should Build Pavements Through Towns

Bottle-neck streets and poor pavements characterize many of the main thoroughfares of cities and towns. A fine, modern state highway often enters a city only to be greeted at the very threshold by a bumpy, beggarly roadway. When the reason for such a greeting is sought, it usually is that the abutting property owners have refused to be assessed for widening and properly paving the street. Nor can you always blame them, for why should they be asked to stand the entire cost of an improvement that is far in excess of their own personal needs? With almost equal justice might a farmer be required to pay the entire cost of a four-track railway through his farm.

This being the condition that confronts us in almost every town, we should set about finding a remedy that will promptly change the condition. For many years we have editorially advocated one remedy, namely, that the city at large pay most of the cost of improving all streets that serve as highways for through traffic. But there are some 10,000 incorporated towns and cities in America, and many officials and voters in each that must first be persuaded to change present assessment practices before this problem can be solved along the lines that we have hitherto advocated. Consideration of the magnitude of this inertia leads us to change our solution of the problem.

Wherever a state highway system exists, let the state build and maintain that part of it that extends through a city or town.

It should not be difficult to secure amendment of laws so as to enable a state to extend its highways through cities and towns, whereas it seems to be impracticable to get cities and towns to amend their street assessment ordinances. Much the same sort of difficulty faces us here as faced the early advocates of better country roads. When the cost of roadwork was entirely borne by the farmers, ours was a country of mud or dust highways. The state-aid plan has largely altered that condition. We advocate the universal extension of that same plan to city and town streets that are arteries of through traffic.

The congestion on many such streets is so bad that traffic is greatly impeded. Even worse, perhaps, are the deaths and maimings that exist where bottle-neck streets cause road-hogging to display itself in its most aggravated form. But there is little need of complaining about a condition that excites complaints from every one. The real need is to diagnose the cause of the disease and to apply the remedy.

Portable Asphalt Plant Does Resurfacing Job

Methods and Costs at El Paso, Tex.

ONE of the never ending things that comes hand in hand with construction is maintenance. In fact, economic equations do not consider original construction cost as an item in the equation. But try and find one that omits maintenance as an item.

Since this problem continually confronted the city of El Paso, Texas, they recognized that it would be more economical for them to resurface some of their rough streets than to reconstruct. They used methods a little out of the ordinary and the city engineer states that they were surprised with the results obtained.

The city owns and uses a Chausse portable hot patch machine for their resurfacing and patch work in conjunction with a home-made hand roller weighing 1,250 lb. This last is somewhat at variance with standard practice, but the city engineer claims to be getting satisfactory results. They use an asphalt of 50-60 penetration and get a thorough mixing from the machine.

The cost data which follow refer to patch work and resurfacing. The resurfacing, as given in these figures, would probably average 1 in. thick. It was laid on a black top thoroughfare street that had become extremely wavy. The surface of the old pavement was thoroughly cleaned, then sprinkled with hot asphalt and the resurfacing mixture applied. Where it was necessary to feather-edge the surface, it is staying put and in place.

The portable mixing machine is a complete small asphalt plant. It dries and heats all material, measures all ingredients, mixes in desired proportion and delivers the hot stuff right handy to the job. The material passes through the rotating sand drier to the measuring devices and then into the pugmixer, where it is mixed with the hot asphalt.

Fig. 2—Showing Results Obtained in the Resurfacing Work

PATCHWORK COSTS
Typical Month

Foreman	$ 150.00
Laborers (6) and watchman	442.59
Asphalt, 20 bbl. at $6.30 (California grade "D")	126.00
Kerosene, 382 gal. at $0.14	53.48
Crushed stone, undersize of ¼-in. screen at $0.50 ton f. o. b. quarry, 73.7 tons	36.85
Sand, 8 cu. yd. at $1.50, delivered	12.00
Gasoline, 144 gal. at $0.14	20.96
Oil, 9¾ gal. at $1.00	9.75
Blacksmith work	17.50
Miscellaneous (lanterns, waste, etc.)	8.95
Depreciation, 25 days at $5.00	125.00
Cost for month	$1,011.99

During the month 762.2 sq. yd. of patchwork was laid which cost $1.327 per square yard. This does not include overhead.

RESURFACING COSTS
Typical Month

Foreman	$ 150.00
Laborers (7) and watchman	474.00
Asphalt, 47 bbl. at $6.30 (California grade "D")	296.10
Kerosene, 519 gal. at $0.12	62.28
Crushed stone, undersize of ¼-in. screen at $0.50 f. o. b. quarry, 135.25 tons	67.63
Sand, 15½ cu. yd. at $1.50, delivered	23.25
Gasoline, 316 gal. at $0.14	12.64
Oil, 14¼ gal. at $1.00	14.25
Blacksmith work	0.35
Miscellaneous (brooms, lanterns, etc.)	14.82
Depreciation, 27 days at $5.00	135.00
Cost for month	$1,250.32

During the month 3,443.8 sq. yd. of resurfacing was laid at a cost of $0.363 per square yard. Overhead is not included.

Fig. 1—Showing Condition of Street Before Resurfacing

Re-Mapping American Cities.—Rapid progress in mapping the cities of the United States according to the economic rather than their political boundaries as a basis for the 1930 census is reported by the Civic Development Department of the Chamber of Commerce of the United States. Of 144 cities of 50,000 and over in the country, 26 are at work preparing the new maps of their metropolitan districts and 27 have already completed their maps. A number of others are preparing to take up the work of tracing the limits of the economic activities centering upon them. From this it appears that more than half the cities of the required size are drawn upon this new scale.

A Municipal Employment Standard

Code for Employees of Berkeley, Calif.

A code of standards for the information of employees of the city of Berkeley, Calif., has been prepared recently by John N. Edy, City Manager. This code, which is distributed in printed form to every new employee of the city, contains so much of interest to municipal employees generally that we are reprinting it below.

In accepting a position in the municipal service of Berkeley, you will want to know these facts:

No Politics.—The service is not conducted along "political" lines and employes are not subject to, nor may they rely upon, political influence. Persons seeking an opportunity to gratify political aspirations or to capitalize public acquaintanceship for political reasons are not eligible for emplomont in the administrative service. This is a measure of protection for you as well as for the public.

Employes may not bring with them into the service any prejudice for or against people or organizations that might affect the cordiality of their contacts with other employes or with the public. Regardless of your position in the service, it is essential that you cooperate cheerfully with all your associates and that you serve all of the public and its several groups with equal interest and loyalty.

Employes are not under so-called civil service, although employments and promotions are predicated upon the merit system. The plan of personnel administration in effect is deemed fair to the public and to the employe; but the final responsibility of the city manager in personnel matters as provided in the charter cannot be delegated or relinquished. One who feels the need of special "protection" in his position should not join the service.

Ability the Test.—People enter and remain in the municipal service exactly as they serve private business: that is, on the basis of the employer's (the city's) need and the employe's character, ability and willingness to give cheerful, competent service under the conditions laid down by the employer (the city). The public does not owe you or me a place on its payroll. If your work or working conditions or associations become distasteful, it is your privilege to discuss the fact frankly with the head of your department or with the city manager, beyond that, and failing an adjustment that satisfies you, your only recourse is to seek other employment, exactly as would be the case if you were working for a private employer.

Opportunity for Advancement.—The position to which you aspire and the work you will do are significant parts of the service. No matter what your duties are, have pride in them; also, maintain your sense of proportion. Yours is but one of many positions, all of them important; your department is but one of several, all of them essential. Loyalty to your colleagues and to your particular branch of the service should but intensify your loyalty to the organization as a whole. There is but one administrative service.

Few persons enter the service in every respect qualified and trained for their special duties; all of us have much to learn. Upon the foundation of your past experience and training it is expected that you will build toward the objective of maximum personal accomplishment. Your future in the service depends upon the extent and success of your efforts to improve yourself and to increase your ability. You may assume that you will never be "too good" for the service; and you may aspire to any position, including department headships and the city managership.

Best Efforts Expected.—The department head under whom you will be employed is engaged to direct the activities of the department and to assume responsibility for its accomplishment. He is a person of character and an expert in his field. You may give him your respect and confidence and loyalty because he is big enough in experience and ability to deserve it. He will expect from you the most conscientious and acceptable effort because he can accomplish his program only with competent and industrious people. His instructions and suggestions will serve as an adequate guide in the performance of your duties. His aid and counsel and that of other depatrment heads and the city manager are available to you in time of personal stress.

You will find that the service is composed of serious-minded men and women aspiring to the attainment of an ideal. This ideal is not a vague, indefinite thing, conceived solely as an object of sentimental regard or framed to trick the public into a false feeling of confidence. On the contrary, it is an intensely practical, workable and attainable ideal, expressed briefly as follows:

The Goal.—The municipal service of Berkeley shall be efficient, business-like, helpful and courteous; and the persons employed to render this service—all of them—shall exemplify these characteristics.

The above will bear re-reading; it is the goal toward which your efforts must lead.

The city does not expect to control your off-duty conduct, but you should remember this: the successful performance of your duties requires that you be at times physically fit and mentally alert. This means fair treatment of your body and mind while off duty. Moreover, because you are part of the municipal government, people will attach special significance to what you say regarding it. Your conduct and your comment will always be interpreted by the public as reflecting the standards or policies of the service, of the head of your department, the city manager and the council. You can never act or speak "unofficially."

Prospective employes often ask what advantages or inducements are offered by the municipal service of Berkeley. As I view it, the answer is quite obvious:

Inducements of City Work.—First—The opportunity to do something that contributes to the totality of comfort and convenience and happiness of some eighty thousand people. That is decidedly worth while.

Second—Remuneration that represents, as nearly as we can determine it, an honest valuation of the individual service, with due regard for the law of supply and demand. That is fair to both parties.

Third—Assurance that within the limitation of appropriations and the program of municipal activities, continuance and upward progress in the service depend solely upon the employe and his ability to grasp the opportunities offered him. No other vocation can do more.

And, Finally—the privilege of working with people who are clean and competent; people whose ideals and aspirations and emotions are similar to yours; people you can respect and like and enjoy. And that is a rare privilege.

Life is not easy. For most of us, there is no material reward without hard work. The municipal service is exacting; but it is an honorable service, worthy of your best efforts and your fullest faith. If you doubt that, don't sign up. If you believe it—and I believe it—you'll get a lot of joy out of the new job.

Kentucky-Tennessee Water Works Men to Meet.—The next annual meeting of the Kentucky-Tennessee Section of the American Water Works Association will be held Jan. 24, 25 and 26, at Chattanooga, Tenn. Mr. F. C. Dugan, Kentucky State Board of Health, 532 W. Main St., Louisville, Ky., is secretary. Knoxville, Tenn., was originally selected as the meeting place, but change has been made to Chattanooga, Tenn.

Maintenance and Operation of Water Distribution

Uniform Service—Operating Cost— The Trouble Wagon—Fire Hydrants

By W. H. HENBY

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THE maintenance, and largely the operation, of a water distribution system, depends to a great extent upon the design and construction. A poor design, however well built, will be costly in maintenance and operation; and a good design poorly constructed may be equally costly to maintain and operate.

It is almost axiomatic that the faults of construction of a good design are less costly to repair or replace than are the evils of a poor design, however perfect the construction.

The ideals sought in maintenance and operation may be considered as follows:

(1) Uniform service.

(2) Comparatively low cost of operation.

(3) Reasonable investment charges.

Uniform Service.—Good service is uniform not only from day to day for the same consumer, but as between consumers in different parts of the distribution system, and it is here that design plays an important part in operation.

To insure service to the consumer who gets water through a long mileage of water pipe, or at a higher elevation, the size of the pipe must be such that the friction-loss will not deprive him of water at times of maximum consumption, or means must be provided for storage in his vicinity to be drawn upon when consumption exceeds the carrying power of the supply mains to deliver at a given minimum pressure. Stand towers or elevated tanks are a useful part of design under these conditions.

To maintain an even pressure in a locality demanding a peak supply at certain more or less irregular intervals, is one of the almost impossible tasks imposed on waterworks operators, and is one that must be worked out in each case as a separate and distinct problem.

Peak loads which come from unusual consumption for filling pools or irregular manufacturing purposes may be provided for by insisting that proper rules for the unusual service be observed.

The peak load due to sprinkling lawns and gardens is more easily prognosticated in point of time, but in a suburban community may amount to several times the usual and regular consumption, so that meeting it with a uniform pressure is almost impossible without having the plant greatly overbuilt.

Uniformity of Appearance of Water.—It is not always possible to get a polished water without a sand filter. If the water is filtered there should be no trouble at all in getting clear, sparkling water at all times, but not all supplies demand filtration. It is this supply that is good enough to make it possible to save the cost of installing filters and filtering that is hard to keep uniform in appearance. Each problem is a separate problem in itself and must be worked out by itself.

Comparatively Low Cost of Operation.—I say "comparatively low cost" because it is always possible to cut cost of operations by lowering the quality of service; and though it is always desirable to lower cost of operation, it is never justifiable to cut costs to the extent that service is impaired.

Operating Costs consist of:

Production cost.

Distribution cost.

General overhead.

Production expense does not concern us in this connection, but the price and manner of distribution is important.

To begin with, the tap on the main which is usually the first contact of the new consumer with the water company. Most water consumers know nothing of the size of tap required and their first reaction to the information that taps on water mains are of various sizes is usually that they want the largest size, assuming that the larger the tap the better service irrespective of other conditions.

For a small house the size of the tap is not of paramount interest, but in the case of a truck gardener who takes only a very small amount of water during eleven months in the year, and wants an almost unlimited supply at the time that other consumers are using a peak load supply, the size of the tap on the main is important, since a few peak load consumers given capacity to draw any quantity of water from the mains may deprive other regular users in the locality of their usual supply, reduce pressure needed for protection from fire, and through sudden and unusual rate of flow through the mains, cause sediment or deposit in the mains to be stirred up.

The size of the tap granted to the consumer should be proportioned to his needs with consideration to the needs of other consumers. A careful, painstaking and complete explanation of the size of the tap sold will often in the beginning of the consumer's relation to the water company make of him a friend to the company, who will cooperate in the future.

The customer signs an application for water service, or a contract for supply, of the nature of which he is usually ignorant and of which he really at that time doesn't care to be informed. An explanation of the scale of rates is worth while and may often save expensive inspections and explanations later. Failing to get the consumer's interest in the rates, it is well to induce him to take away with him a copy of the application he has signed.

After the residence is completed and the consumer is occupying the premises, the first water bill is apt to justify careful attention. In the first bill at a new home there is all too often the cost of water wasted through new plumbing, that on account of lack of proper adjustment leaks badly, and the cost of constant watering of a newly sodded lawn, and the unusually large quantity of water used in cleaning and shaping up after the contractors. The bill is large—larger than future bills are apt to be, and here again the cost of inspecting plumbing without charge and advising about consumption with the consumer is a justified part of the cost of distribution.

When the new consumer has received and paid his first bill to the company and feels that the company is interested in his account, he is in a fair way to remain a satisfied consumer.

The Trouble Wagon.—This much-maligned part of the equipment of every distribution system is a cross that must be borne by every management. It may consist of the overtime of a hard-worked, general utility man, or the superintendent, who may find after he has been on duty for twelve hours, he is the trouble wagon for twelve more hours in the same day. If the plant is larger, several gangs with trucks may be the day shift, with one well equipped gang for night duty. I've never found a night gang to be too well equipped.

The trouble wagon appears on the payroll with great regularity, but pays no dividends in money, and money is the unit that stockholders and auditors use in measuring successful operation. The manager who fears the evils of mounting costs and tries to economize by cutting down on this part of his work is apt to find himself in worse stead.

The duties of the trouble wagon consist of meeting the unusual—the unlooked for—the unexpected demand for repairs that cannot wait for the regular order of operations—as a break in a water main, or failure of a fire hydrant to function properly during a fire, often caused by fire fighters endeavor-

ing to open a standard fire hydrant by turning to the right; and the complaint of consumers of muddy water, of lack of pressure, of over-registration of meters, of noisy meters, of incivility of employees, etc. Many of these complaints are trivial and inconsequential, but they must be met and answered and the proper inspection and answering is a material part of operating expense.

All of the complaints are not trivial by any means, and the company that fails to investigate all reports is in a fair way to get into serious trouble by neglecting them.

Fire Hydrant Maintenance.—The function of fire hydrants is to provide a means for fighting fires. A fire may be reported in any part of the area at any time of the day or night, and unless there is a proper water supply with proper pressure in all of the mains, and all of the hydrants are in proper operating condition all of the time, the service is apt to fail.

To make it possible to give the hydrants proper attention without inconveniencing water consumers by shutting down mains, we put a gate valve on every fire hydrant lead.

All hydrants are flushed, packed, oiled, painted and are not passed as properly inspected until they are found to be draining properly, in October and in the first part of November of each year. After this general inspection, of which a record is kept of the work done on each hydrant, the section foremen are made responsible for the hydrants in their respective districts, and look out for evidence of tampering with the hydrants, which may result in their being out of commission when needed. Unauthorized persons sometimes open the hydrants with Stillson wrenches to get water for various purposes and sometimes damage the hydrants. In a large distribution system, some of which is sparsely occupied, the water company cannot effectually police all its hydrants all the time, so a constant alertness to detect and repair possible damage is required.

After the general inspection in the fall just before freezing weather begins, the next general inspection comes with the breaking up of the frost in early spring, in which inspection the condition of each hydrant is recorded.

Most dangerous fires occur at night. To aid the firemen in locating hydrants when they are not near a street lamp, we have adopted the uniform practice of painting the top or cap of the hydrant with aluminum paint, which will reflect any light there may be and makes the hydrant easy to find. The body of the hydrant is painted black to make it as inconspicuous as possible.

The location, spacing, operation and maintenance of gate valves is a fruitful theme for discussion, but not now.

Acknowledgment.—The above is a paper presented Nov. 16 at the Missouri Conference on Water Purification.

Combined Water Tank and Lookout

Wentz Camp, which is located four miles northeast of Ponca City, Okla., is one of the best equipped boy scout camps in the country. It comprises 160 acres on which barracks have been erected and improvements made to accommodate a maximum of 1,000 boys.

The camp is open the year 'round,

Combined Water Tank and Tower at Wentz Camp

but the chief activities will take place during the summer months, when groups of boys from Oklahoma and neighboring states will stay for periods of three weeks each. Construction and management is in charge of a staff headed by Roy W. Williams.

One of the first things the visitor sees as he approaches the camp is the combined water tank and lookout. It is an interesting structure shaped something like a giant scepter. The spherical portion is 21 ft. in diameter and holds 30,000 gal. of water, which is used as a general supply for the camp. The tower or cylindrical portion is 7 ft. in diameter and 75 ft. high. It encloses a circular stairway which extends through the tank to a platform or lookout 10 ft. 6 in. in diameter. This observation point, which is 94 ft. above the ground, is surrounded by a lattice fence and equipped with a telescope and searchlights.

The steel plates used in building this structure range from $\frac{7}{16}$-in. to $\frac{5}{8}$-in. in thickness. They were fabricated at the Western plant of the Chicago Bridge & Iron Works and erected by one of that company's field crews.

A swimming pool and additional buildings are under construction at the present time.

Traffic Waste

As a measure of the possibilities of saving money through modern traffic regulation and control, A. B. Barber, Director of the National Conference on Street and Highway Safety and Manager of the Transportation Department of the Chamber of the United States, points to the enormous losses due to traffic congestion.

"Aside from the human factor," he says, "cities using modern traffic methods are receiving a direct dollars and cents return.

"A survey of traffic delays in downtown Boston showed that they cost the community $24,500,000 a year, in addition to losses from accidents amounting to more than $2,000,000 a year. Chicago's cost of traffic congestion has been estimated to be in excess of $600,000 a day and New York's more than $1,000,000 a day. The nation's bill for traffic delays is conservatively placed at $2,000,000,000 a year.

"There is another side to the picture. San Francisco found that its new traffic code resulted in reductions of accidents ranging from 30 to 40 per cent in the records of companies operating 50, 100 and 400 motor vehicles. One street railway company reported a reduction of 24.7 per cent in pedestrian accidents. A saving of $2,000,000 a year in the cost of automobile accidents is being made for San Francisco motorists. Los Angeles reports an increase of 30 per cent in the movement of street traffic after revising its regulations."

New Journal for Sewage Field

The Federation of Sewage Works Associations published the first issue of Sewage Works Journal during October. This is a "quarterly journal devoted to the advancement of fundamental and practical knowledge concerning the nature, collection, treatment, and disposal of sewage and industrial wastes, and the design, construction, operation, and management of sewage works." It is published at the Association's headquarters, 20th and Northampton Sts., Easton, Pa. The Journal is edited by Dr. F. W. Mohlman, chief chemist, The Sanitary District of Chicago, 845 South Wabash Avenue, Chicago, Ill. William F. Buffum, general manager, The Chemical Foundation, 85 Beaver St., New York City, is business manager. The Journal has a page size of $6\frac{3}{4}$ by $9\frac{3}{4}$ in. and a type page of $4\frac{1}{2}$ by $7\frac{3}{8}$ in.

Oderless Operation of a 2-Story Sewage Treatment Plant

How Conditions at Plant City, Fla., Were Remedied

By CHARLES CARROLL BROWN
Associate Editor, Municipal News and Water Works

VISITS during the past two years to some 50 medium and small sized sewage treatment plants have shown that practically none of them are operated without odor and most of them are either (1) entirely neglected; (2) operated by incompetent men; (3) badly designed; (4) subject to some special local conditions not properly understood; or (5) subject to the common condition of frost and cold for a part of the year, the consequences of which cannot be or at least are not entirely overcome during that part of the year which is favorable to odorless operation. The nuisance created by the three first mentioned conditions is in some cases so slight or the plant is so far removed from habitations that it is neglected or is tolerated rather than spend the money required to remove it entirely. Climatic conditions are of paramount importance but may be overcome in large measure by proper operation and expenditure of enough money. It is inexcusable, except on the ground of ignorance, to permit nuisance from sewage treatment plants where climatic conditions are favorable. This article describes the operation of a plant under such favorable climatic conditions after some defects in its original design were corrected, although the design as a whole is not in conformity with the best practice.

The Situation at Plant City.—The writer was asked by the city manager of Plant City, Fla., to devise some method of operating two small circular 2-story sewage treatment plants which were producing nuisance during much of the year, some in the plant itself but more in the ditches into which the effluents were discharged. During the rainy season of the summer this nuisance is reduced to a minimum owing to the washing out of the accumulations in the ditches and the dilution of the effluent from the plant by a constant flow of clear water. The city manager's idea was that the plant was overloaded and that he would replace it by a larger one as soon as the citizens would vote the money to pay for it. The result shown by this article is that the plant is ample for some years and the fault has been in the operation, or rather lack of operation in the past.

The city is on a watershed boundary line so that it is rather flat and slopes in two directions, making two outlets and two small sewage treatment plants necessary, one at each end of the city. The sandy soil and level area mean much ground water, especially in the rainy season, which, however, flows slowly on account of the fineness of the sand. Tight sewer joints are evidently necessary to keep out both water and sand, but they were not secured and, moreover, a former city engineer, in an effort to reduce the cost of construction of considerable additions to the sewer system, made concrete pipe without expert workmen and supervision and these pipes have disintegrated with the result of much fine sand reaching the treatment plant during the rainy season. These defective pipes are being replaced as rapidly as they show up.

The plants are duplicates and one of them will be described since the other is in the line of a new state highway, construction of which is expected to begin soon after the official changes which may be made as results of the November elections. A design for a new plant has been made and duly approved by the State Department of Health.

The Old Plant.—The old plant, of reinforced concrete, is in plan a circle of 22 ft. inside diameter, the cylinder being 19.5 ft. inside and 21 ft. outside depth with a cone-shaped bottom of 6 ft. inside height, the 8 in. iron sludge pipe being set on feet at the lowest point, at the center of this cone. There are 4 ft. 9 in. of clear cylinder between the cone and the base of the two sloping bottoms of the sedimentation chamber, which is also the level of the bottom of a concrete hanging wall across the flow line of the sewage and serves as a brace across the cylinder; a wall dividing the sedimentation chamber into two parts so far as the sloping bottoms extend, and as a support for the walls between the sedimentation chamber and the gas chambers. The full sedimentation chamber is 18 ft. wide on top and where its vertical sidewalls intersect the outside cylinder walls it is 12 ft. long and 6.5 ft. deep. Below that depth there are two triangular bottoms each 9 ft. wide and 8.25 ft. deep over all. Up through the middle of the sedimentation chamber, over the sludge-cone bottom, and with the sludge pipe coming up through it, is a gas chamber or vent, 2 ft. wide and 5 ft. long in the direction of flow of sewage. The original plans show a branch to the sludge pipe which would let sludge flow out on opening a valve, but this was not put in and there is no way of getting the sludge out of the tank except by pumping through the sludge-pipe or through hose let down in a gas vent. It will be noted that the position of the outside walls of the sedimentation chamber leaves two lunes between the walls and the outside wall of the tank. These lunes are nearly 12 ft. long and have a maximum width of 1 ft. 8 in., the walls of the sedimentation chamber being 4 in. thick. These lunes serve as gas vents or chambers, making three chambers in all.

Cycle of Sewage Flow.—The sewage enters the tank through a 15 in. pipe with a T which distributes the flow in two directions. The sewage flows through the sedimentation chamber parallel to the bottom slots (1) across a lune about 5 ft. in center width; then (2) it flows under a creosoted wood baffle; thence (3) along 12 ft. of sedimentation chamber around the central gas vent and between the two side gas vents to another creosoted wood baffle under which (4) it passes to and through 3.5 ft. of a 5 ft. lune like the one at the inlet; whence (5) it passes over a weir into a lune-shaped channel with a bottom which leads it (6) to the 15 in. outlet pipe. The total distance of flow of sewage from inlet pipe to outlet weir in a straight line is not quite 20 ft. The surface of water in the tank (elevation of discharge weir) is 1.5 ft. below the top of the tank described above. It would be possible by a proper arrangement of surface and submerged baffles and channel walls to increase the length of flow of the sewage to perhaps 50 ft., but the normal dry-weather flow of sewage is so small that this was thought unnecessary at present although plans were made for such channels in case further increase in sewage results in too short detention in the sedimentation chamber.

Cause of Lack of Purifying Action.—The first step in revising the operation of the plant was to pump it out and clean it thoroughly. When this was attempted the reason for lack of purifying action in the old plant was shown. The tank was so full of sand that when the water was pumped out of one of the four sectors into which the sloping bottoms of the upper story and the cross wall divide the middle depth of the tank, it could not be drawn from

one of the adjoining sectors, showing complete stoppage of the lower story and of the slots supposed to lead sludge to it. It took several weeks to dig the sand out as it was too heavy and thick to be pumped out with the machinery at hand and the width of openings into the lower story was only the 20 and 24 in. in the gas chambers or vents, as above described. At the bottom some of the form boards for pouring concrete during construction were scattered about or still in place, practically stopping the slots. The time of building the tank was not ascertained but was certainly more than seven years ago. The attention which the plant has had since its construction is easily estimated. This would not be mentioned but for the fact that it is not exceptional. Several plants seen in both the north and the south seem not to have been touched since put in operation and most others are so ignorantly operated that the labor is practically thrown, away, if judged from the unsatisfactory results obtained.

Some of the operators of medium size plants with which the writer is acquainted have been able to reduce the nuisance about their plants during favorable seasonal conditions by rather simple but laborious treatment and it seemed probable that small plants might be greatly benefitted by similar treatment, particularly plants in the South where the temperatures in the treatment tanks are never low enough to reduce bacterial activity to a serious extent. Some preliminary experiments indicated that such operation of Imhoff tanks should be reasonably successful in plants treating domestic sewage, and that proper chemical control observations would lead to modifications of a program for a simple sewage treatment problem which could be made applicable to sewage of more complicated content on account of industrial or other wastes mixed with the house sewage. These experiments will be reported upon later. The present article is confined to the description of a strictly house-sewage treatment plant.

Additions to the Plant.—As a preparation for the treatment three additions were made to the Plant City design.

1. The preliminary tests showed that rags, large papers, and the like after settlement into the digestion chamber (lower story of Imhoff or similar plants) were lifted by formation of gas or otherwise and gathered on top of the gas vents, chambers or channels, as they are variously called. If the tanks were neglected this led to the decomposition of sewage meshed in the mass of rags and paper where aerobic action is pronounced and gave rise to very objectionable odors, not all of them from hydrogen sulphide. Insertion of a bar screen stopped these larger fibrous masses and the screenings were buried as raked from the screen.

2. A grit chamber was inserted to catch the sand as it arrived, this sand being removed daily or oftener if necessary in the rainy season, thus preventing hardening and excessive weight of the digested sludge. The necessary pumping of the digested sludge in the Plant City plant was thus made as easy as possible.

3. Water and under pressure enough to operate a 1½ in. nozzle if desired was piped to the plant.

The foreman was instructed to leave as much sludge as possible in the bottom of the tank when it was cleaned and at the same time to remove as nearly all the sand as possible. He did a good job as there seems to have been no trouble in starting the digestion of sludge in the tank as soon as the sewage was again turned in.

Daily Program of Operation of Imhoff Tanks.—The foreman was furnished with the following program and given instructions to follow it exactly and completely each day and especially to keep everything about the plant perfectly clean and to bury the screenings and sand from bar-screen and grit chamber as soon as removed therefrom.

1. Rake off the screen, breaking up any fecal matter so it can pass through the screen with the sewage.

2. Draw the sand out of the grit chamber, letting floating matter, except wood and rags, flow on with the sewage.

3. Collect the two above and put into wheelbarrow to be hauled off and buried. If held over to get a barrow load before burying odors will be given off.

4. Wash off the screen and walls above and below it, and the platform of the grit chamber, forcing the washings into the flow of sewage.

5. Use the hose in breaking up the scum on the surface of the sewage in all the sections of the tank formed by the baffle boards, working backwards from the outlet. Should there be much scum in the section at the outflow weir, shovel or dip it over into the scum chamber, so that it will not flow over the outlet weir.

6. Use hose or rake or both in breaking up the scum in the three scum chambers until it is soft and mushy and all lumps are broken up and thoroughly soaked with water. Be sure to leave all wall surfaces clean.

The above operations should be gone over every day. If properly done and frequently it should never require more than a couple of hours for one man, and may usually be done in an hour or less. The other operations, using hydrated lime or chloride of lime will be required at longer intervals, unless the plant should be neglected for a time, in which case hydrated lime should be applied daily until the plant is brought back into condition.

How to Prevent Odors from the Sewage Disposal Plant.—The city manager was supplied with the following explanatory statement of the foreman's program.

1. The plant **must be kept clean**. Whenever in the operation of the plant any of the sewage is spread on the walls or floors of any part of the plant, it must be washed off and the wash water run into the tank or into the stream of sewage running into the plant. This applies to screen and grit chamber as well as to the Imhoff tank. When any rakings from the screen or from the grit chamber are collected they must be buried or burned in incinerator, together with any polluted soil or vegetation. Whenever necessary fresh clean sand must be filled into holes made by shoveling out such polluted soil.

2. The scum which forms on the surface of the sewage flowing through the Imhoff tank must be broken up so that it can settle, at least once a day and oftener if necessary. This can be done best by means of a spray from a hose nozzle. If the spray is used to drive this scum back toward the entrance of the sewage into the tank there will be less floating matter driven under the baffles and so out of the tank without sedimentation and decomposition in the tank. This part of the work is easily and quickly done and if done every day, and the walls washed down, there will be no development of mosquitoes and flies in the scum.

3. The scum rising in the scum or gas chambers in the center of the tank and in those on the east and west sides may produce nuisance. To prevent this as much as possible, this scum should be broken up and mixed with water so that it will be soft and quite liquid. This should be done every day and can be done with water from the hose or by means of a rake or squeegee or hoe, or partly by water and partly by hoe. The scum will not all settle but can be kept odorless by this breaking up every day. Any scum forming in the iron pipe from which sludge is pumped should be broken up also. If this breaking up of scum is neglected for 3 or 4 days flies and mosquitoes will develop, even in the sludge pipe.

4. If the scum thickens to a depth of a foot or two and cannot be reduced by the operations described under (3), mix as much hydrated lime in a pail of water as it will carry and spread a pail of this lime water over the scum in each of the three scum chambers. Keep this up each day as long as is necessary to work the sludge down to the ordinary thin layer. If for any reason these scum chambers should be neglected for a few days, considerable odor will develop and more lime water must be applied when the scum is broken up, say 5 or 6 pailfuls in each chamber, or even more, each day until the odor is stopped. Keep all tank surfaces clean.

5. Do all the work carefully so as to help the floating matter to settle and to stir up the floating matter below the surface as little as possible so that little

will flow out through the outlet. Should odors develop in the ditch below the plant, which may happen when the ditch runs dry, as it may in the winter season, they may be reduced by dosing the outflowing stream at the plant with chloride of lime. That these odors will be serious is not probable. The amount of chloride of lime and the manner of applying it cannot be predicted in advance. Possibly the quickest and most effective action under your conditions would be to siphon out of a barrel of solution of chloride of lime drawn along the bank of the ditch, enough to stop the formation of odors by the decomposition in the ditch. A single treatment may be sufficient, or possibly one a week until you have rainfall enough to wash out the ditch.

6. Ordinarily sludge should be pumped out about once in three months. If there is any odor or any gas observed in the sludge as it is pumped it is not yet fully digested and pumping should be stopped and the sludge be left in the tank for several weeks before pumping again. If left in the tank long enough to be fully digested the sludge will have no odor beyond a slight musty odor and when dried can be used for filling or grading. Should any flies develop about the wet sludge, sprinkle it with chloride of lime enough to kill the larvae before they hatch any more flies, or haul the sludge off and cover it with a sprinkling of sand enough to absorb the surplus water in it.

The Results at Plant City.—The writer was absent from the state during the summer months, during which time the screen and grit chamber were installed, the tank was cleaned out and put into operation. A visit late in September showed everything to be operating perfectly and the only odor about the plant was a slight odor from the fresh sewage as it passed into and through the screen and grit chambers. As they are covered with removable plank covers this was scarcely noticeable even when the covers were lifted for inspection. The visit was paid during the week after the heaviest West Indian storm on record, during which about 10 in. of rainfall was the record for 24 hours at Lakeland, about 6 miles east. Enough water had come through the sewer to overflow the screen chamber, but the sewage was so greatly diluted and the outlet ditch was so near by that no odors were developing.

Although constant operation on the program as laid down will prevent development of flies and mosquitoes, removable screens (sectional) were laid horizontally over the tanks, resting on the various division walls and baffle boards to make them easy to handle and will prevent this nuisance in case operation daily is intermitted for a time. During the rainy summer season the sewage is less in Florida towns, because of lack of tourists, and the dilution is great, even in this separate system of sewers, for the reasons given above. It is possible that operation of the program every other day or twice a week might be sufficient. However, the work on the experimental plant above referred to indicates that daily operation is necessary for the larger population and greater sewage concentration of the dry season, covering fall, winter and spring. Intermission of the program for two or three days makes scum harder and thicker and requires more squeegee and water work and also use of lime so that there would be but little if any saving of time over daily operation.

The operation of the plant during the following winter season will be watched with interest and any changes in operation or any correction of abnormal conditions will be carefully worked out under the methods of control worked out and now under study in the experimental plant.

Other articles on plants which are working for like results under conditions much more difficult will be given from time to time, with the hope of deriving some standards with which to attack the problems where they are fairly uniform, as they are in Florida, as well as to show what needs or does not need to be done in separating wastes which destroy uniformity in constitution of sewage either by varying constitution of such wastes or by irregular discharge into the sewer system. Neutralization of the effects of frost is being worked on by every sewage plant engineer or operator. The work in the simpler plants may solve many partial problems making it easier to work out a solution or solutions for the most difficult one.

Urges More Parks and Playgrounds as Highway Safety Measure

A vigorous plea for the construction of more public playgrounds in cities, and foot paths along country roads has been made by the American Road Builders' Association.

"The unwarranted slaughter of children by motor cars and trucks is linked closely with the general problem of safeguarding pedestrian traffic," stated Chas. M. Upham, secretary-director of the Association. "Statistics show that 7,400 children of school age were killed on the highways of the United States in 1927, and of these children, 3,638 were killed while at play in the streets. More than twice as many children between the ages of 5 and 10 years were killed than of any other similar period of years."

In discussing this problem of child safety Mr. Upham states, "There are entirely too few playgrounds and recreation centers and children in many cities are forced to play in the streets. Roller skating on highway pavements should be discouraged, as well as tobogganing, coasting or sledding.

"Public school officials, parent-teacher associations, churches, civic organizations and parents, in particular, are urged to promote the establishment of public and private playgrounds in cities and towns, with a view to affording children a greater number of safe places where they can play."

"More than $1,000,000,000 have already been invested in public parks and playgrounds, covering 250,000 acres, all told, and more than $100,000,000 is being expended annually for their maintenance. Practically all cities with more than 25,000 population have at least one park or playground but many millions of children, especially in the smaller cities, do not have access to parks or playgrounds and all too frequently go into the streets. These children should be encouraged to play upon vacant lots where possible. They must be kept off the streets.

"Investigation of highway accidents in which children are the victims shows that the principal causes are roller skating; playing in the street; sledding and coasting; stepping from behind passing or parked automobiles or trucks, or in front of backing ones; walking or running in the highway; running around a passing street car; darting out from the curb without observing traffic; hopping on automobiles or trucks, and similar bits of recklessness. Most of the accidents occur during the school vacation periods.

"During the school year the accidents occur principally on Saturdays. Children from 5 to 10 years of age are the most frequent victims. The most dangerous period of the day is from 4 to 6:30 P. M., when the children are more likely to be in the streets and when traffic congestion, due to the rush hours, is heaviest. The slaughter annually of approximately 7,000 future citizens of the United States by motor cars and trucks on our highways can be practically eliminated through education and the exercise of proper caution. Regulation of pedestrian traffic along with vehicular traffic is one remedy that is beginning to receive serious attention.

"Formation of schoolboy patrols, class room instruction in the public, parochial and private schools, posting of safety bulletins and constant warning from parents will go far to promote caution among the children and minimize the number of child accidents."

Water Works in Kansas.—According to statistics collected by the League of Kansas Municipalities there were 261 water works in Kansas on Jan. 1, 1923, 264 on July 1, 1925 and 283 on July 1, 1927. All the water works with the exception of six are municipally owned.

Asphalt Cold Mixes for Re-surfacing Roads

Methods and Costs of New Product Explained

By ALLAN K. HAY

Engineer to Ottawa Suburban Roads Commission, Ontario

DURING the past few years the Ottawa Suburban Roads Commission has been developing the use of asphalt cut-back mixtures for construction and resurfacing of heavily travelled highways. These mixes are prepared and spread without heating, being composed of crushed stone and an asphalt cold-patching product and are used at certain locations where the size of the work is too small to attract bids from contractors building the more usual types of hot mixed pavements. In the summer of 1928 a distance of 2.6 miles was built on the Metcalfe Road, which forms a link on one of the main highways between Ottawa, the Canadian capital, and the New York State boundary. On account of the heavy tourist traffic it was desirable to build a type of surface which would not require motorists to detour.

The existing road was a penetration macadam in fairly good repair but having a wavy and irregular driving surface and width of only 15 to 16 ft. with heavy annual shoulder maintenance. This roadway was used as a foundation without scarifying in any way, but was first widened by the addition of a strip of concrete, 6 in. in depth, the new width attained being 18 ft. on straight road and 20 to 26 ft. on curves, of which there are many.

On completion of the widening 3x6-in. planks were set along the edges and the new surfaces spread and compacted in two courses, the lower course of about 1½ in. to 2 in. and the upper course of 1-in. depth after consolidation. On completion a seal coat of premixed sand and asphalt cold-patch was broadcasted and rolled over the finished pavement. Traffic was allowed to proceed through the work at all times.

Mixing Plant.—The mixing plant for this work is very simple and exceedingly economical in cost. It is in fact merely an extension of the practice of using a small concrete mixer for cold-patching on roadway repair work. The plant operated on this job consisted of a second hand steam-driven concrete mixer with a tilting drum having a capacity of about 13 cu. ft. of coarse aggregate, this being mounted below a substantial timber platform and near a stone crusher. In operation, crushed stone is conveyed from the crusher bins to this platform, is dumped into the hopper of the mixer, the requisite quantity of asphalt cold-patch is added and the mixer discharged into trucks below.

Asphalt cold-patching material was used, having a somewhat higher bitumen content than that commonly supplied for patching work.

All stone was crushed to pass a 1¾-in. ring and was separated into two sizes:

A, from ¾-in. to 1¾-in.

B, from ¼-in. to ¾-in.

the dust of crushing being also separated and not used in the mix.

Size A was used for the first course and size B for second course.

It will be noted from the above that no attempt was made to approximate a graded asphaltic concrete mix by the addition of sand or other fine material, as such a procedure is impractical with cold-mixes of this type. The whole process was based on the theory that stability in the finished roadway would be obtained by the mechanical interlocking of the individual stone particles in the same way as in penetration macadam.

The finished pavement was covered with a rich mix of cold-patch and coarse sand, spread and rolled to an amount just sufficient to fill the surface voids and thus waterproof the whole. This sand seal coat worked out at a weight of 12½ lb. per square yard, the total weight of the whole new pavement averaging 295 lb. per square yard. This amount was governed largely by the condition of the old foundation, surfaces of greater and of less unit weights having been laid on other roads. On work of this kind a surface treatment with hot liquid asphalt is usually applied one year after construction and produces a finished pavement which compares favorably in appearance with hot-mixed types. The Commission has built short stretches of similar roadway, some of which are four years old and are giving excellent service under heavy traffic and severe climatic conditions.

Cost per Mile

Widening old roadway with concrete	$1,240
Cold-mix surface	8,000
Grading (earth shoulders and embankment)	3,640
	$12,880

Cold-Mix Surface

		Cost per ton of mixed product
(1) Mixing:		
Setting up plant	$0.057	
Labor mixing	0.705	
Asphalt cold-patch	1.467	
Crushed stone and sand	1.300	
Coal for mixer	0.032	
Plant rental, overhead and sundries	0.193	$3.754
(2) Cartage from mixer to road: (Average haul 1.3 miles)		0.340
(3) Spreading and rolling:		
Labor	$0.564	
Plant rental, etc.	0.126	0.690
Total		$4.784

At 295 lb. of cold-mix per square yard, this is equivalent to 71 ct. per square yard. The following data are pertinent to the above costs:

Ten hour day.

Foreman, 55 ct. per hr. Roller-man, 75 ct. per hr. Mixer operator, 50 ct. per hr. Labor at 40 ct. and 35 ct. per hr.

Crushed stone at contract price of $1.30 per ton delivered at mixer.

Cartage contract at 34 ct. per ton.

Asphalt cold-patch used at rate of 7 gal. per ton of mixed product and cost 23 ct. per Imperial gallon (not U. S. gallon) delivered in barrels at mixer about 11 mi. from R. R. siding.

Portland cement $2.55 per bbl. delivered on road.

Coal $9.50 per ton at mixer.

All material weighed on 10-ton platform scale located in quarry. Cost of weighing included.

Meetings of the National Highway Traffic Association

The following list of meetings of the above association have been announced. Programs can be obtained by addressing the Workshop, National Highway Traffic Association, 12 Dennison Bldg., 515½ Jefferson Ave., Toledo, O.:

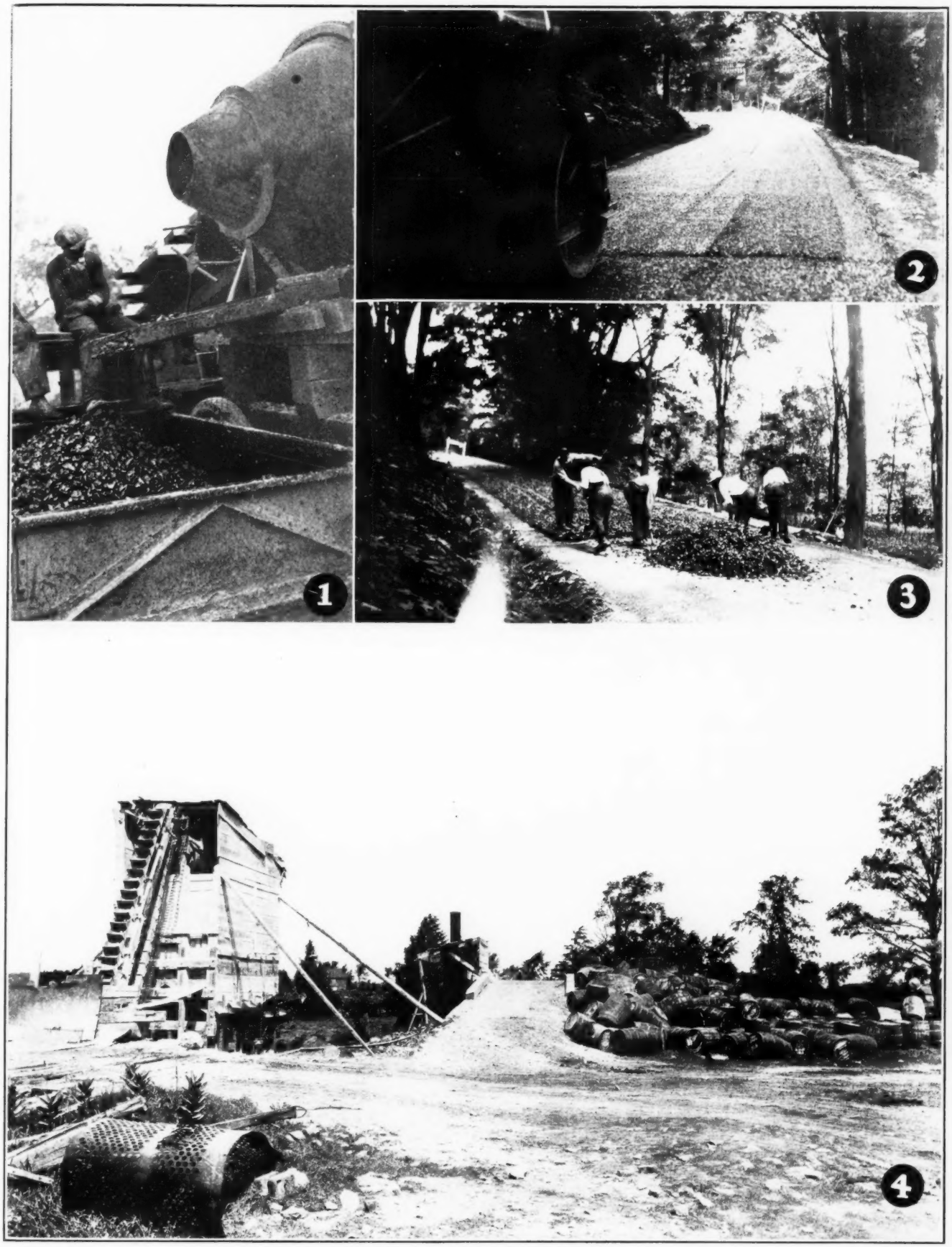
Dec. 3, 1928: Meeting of South Central Division of the National Highway Traffic Association, Hotel Roosevelt, New Orleans, La.; secretary, Elmer Thompson.

Dec. 10, 11 and 12, 1928: Annual meeting of the National Highway Traffic Association, Automobile Club of America, New York City; secretary, Elmer Thompson.

Jan. 15, 1929: Meeting of the North Central Division of the National Highway Traffic Association, Cleveland Hotel, Cleveland, O.; secretary, Elmer Thompson.

Jan. 17, 1929: Meeting of the North Atlantic Division of the National Highway Traffic Association, Automobile Club of America, New York City; secretary, Elmer Thompson.

May 13, 14 and 15, 1929: Annual convention of the National Highway Traffic Association, Stevens Hotel, Chicago; secretary, Elmer Thompson.



Pictures of Construction on Metcalfe Road by Ottawa Suburban Roads Commission

Fig. 1—Showing Use of Old Steam Driven Concrete Mixed for Preparing Cold-Mix Material. Fig. 2—Cold-Mix Surface Construction, Village of Radcliffe, in 1927, on About 10 Per Cent Grade. Fig. 3—Showing Spreading of Batches on Same Job as Fig. 2. Fig. 4—Showing Mixing Plant and Platform Over Mixer

Are Essentially Uniform Municipal Traffic Regulations Utopian?

An Interesting Discussion of an Outstanding Problem

By ARTHUR H. BLANCHARD

Consulting Engineer, National Highways Association, and President, National Highway Traffic Association

WHAT is meant by essentially uniform municipal traffic regulations? The stress is on the phrase "essentially uniform." Why? Because there is a vast difference between municipal traffic regulations which are uniform based on the desires, it may be said the demands, of motorists and operators of trucks and buses, and municipal traffic ordinances and regulations, which might be identical, in every city, incorporated and unincorporated village, and hamlet in the United States.

What an Ordinance Should Cover.—What should be the underlying fundamental principles upon which should be based traffic regulations formulated for adoption in every municipality throughout our land? An "essentially uniform" traffic ordinance should definitely cover every traffic regulation which cannot be readily and practically indicated by signs and signals.

Safety of pedestrians and vehicular operators positively requires that signs at street intersections should be of a number approaching the irreducible minimum as the desirable limit. For example, when we find the vehicular operator required to read numerous signs such as "No U Turns," "Right Turns Prohibited Between 4:00 and 7:00 P. M.," "Lane at Curb for Right Turns," "Left Turns Only Permitted by Direction of Traffic Officer," "Thru Street, Speed, 35 Miles per Hour," "Hospital District, Quiet," "School Zone, 10 Miles per Hour," and "Lane Next Center for Left Turns," how are we to expect the bewildered motorists will be able to cooperate with the National Safety Council and assist in reducing automobile accidents and fatalities?

The Model Ordinance.—The latest attempt to formulate, promulgate and have unanimously adopted a "Model Municipal Traffic Ordinance" was sponsored by the Hon. Herbert Hoover. The product of the brains of practically one hundred men comprising the committee has been published and distributed broadcast. What of the result? In the opinion of many, it is not as satisfactory as its framers anticipated, from the standpoint of that fundamental desideratum, namely, "essentially uniform."

The "Model Ordinance" is not 100 per cent satisfactory because it contains, relative to several important sections, the dictum. "If you don't like this traffic control recommendation, please adopt the following alternate regulation."

Two examples of alternate regulation embodied in the "Model Ordinance" follow:

Traffic Control Signal: Primary recommendation, three-color system; alternate recommendation, two-color system with a different meaning for the red signal than in the case of the three-color system.

Car Track Adjacent to Safety Zone: Primary recommendation, driving on car track permitted; alternate recommendation, driving on car track prohibited.

Why the Alternate Regulations Were Included.—The reasons for the inclusion of the alternate regulations are apparent to anyone familiar with the formulation of traffic ordinances. Sidney J. Williams, Director of the Public Safety Division of the National Safety Council, hit the proverbial nail on the head when he said "There are a hundred million traffic experts in the United States."

To Discuss Controversal Regulations.—In the hope that the basic facts underlying the reason for the marked differences of opinion relative to controversal traffic control regulations may be analyzed and that solutions of the related problems may be finally found, the Executive Committee of the National Highway Traffic Association has placed on the program of the New York Annual Meeting, to be held on Dec. 10th, 11th and 12th at the Automobile Club of America, progress reports of National Committees to which have been assigned many of the bones of contention which developed at the meetings of the Hoover Committee.

Is there any hope for the adoption of an "essentially uniform" municipal traffic ordinance? The reply is in the affirmative. The method proposed may savor of Il Duce, but it must be remembered that Mussolini has accomplished wonders in Italy for which he probably will be classed as a "Saint" by succeeding Italian generations.

Hope for Relief.—There is a "Star of Relief for Traffic Control Chaos" slowly rising at Washington. When Congress shall have passed a bill providing for the establishment of a system of National Highways, as advocated by the National Highways Association and comparable to that under the jurisdiction of the National Department of Roads and Bridges of France, then we may hope for the adoption of an "essentially uniform" municipal traffic ordinance.

As the states now adopt legislation which controls traffic on their highway systems, it is natural to presuppose that Congress will empower the United States Bureau of Public Roads, a National Highway Commission, or the Interstate Commerce Commission to formulate and enforce regulations applicable to traffic on all highways comprising the National System.

The effect on state regulations will be apparent. It is not conceivable that the motoring public would long tolerate one set of regulations controlling traffic on National Interstate Highways within a given state and different regulations on the intrastate highways outside of urban districts.

As the National Traffic Regulations would apply to incorporated and unincorporated villages, and small and large cities, the gradual adoption of an "essentially uniform" municipal ordinance naturally would follow and order out of chaos would be forthcoming.

Acknowledgment.—The above paper was presented Oct. 23 by Mr. Blanchard at the Detroit convention of the American Society for Municipal Improvements.

Model Airport for Philadelphia

It has just been announced that the contract for design and superintending construction of the Central Airport at Camden, New Jersey, has been awarded to Black & Bigelow, Inc., Air Transport Engineers of New York City.

This airport is ideally situated on the main road between Philadelphia and Atlantic City, only four miles from the Philadelphia City Hall. The property comprises about 184 acres and is owned by Central Airport, Inc., an organization recently formed by Messrs. C. T. Ludington, C. M. Keys, Harold F. Pitcairn, N. S. Ludington and other leaders in the aviation industry.

The design of the airport will be placed in the hands of Mr. Archibald Black, president of Black & Bigelow, Inc., and construction work will be in charge of Mr. J. C. Worthington, construction engineer of the same firm.

Electric Pumpage at Kansas City, Mo.

New Stations Have 13,200 Volt Motors and Electric Radiators

By ALBERT L. MAILLARD
Consulting Engineer, Kansas City, Mo.

IN the new $11,000,000 addition to the water works of Kansas City, Mo., there are included three pumping stations, one high lift and two low, all of which are electrically operated. Moreover, the power for these electrically driven pumps is purchased from the Kansas City Power & Light Co.

The Original Studies.—In the original studies made by Fuller and McClintock in 1920, steam driven pumps were considered for all stations. Later studies pointed to part steam and part electric drive. This latter scheme contemplated a high lift steam driven pumping station and electric power plant combined, thus confining all steam generation to one central location. The low head stations were to be electrically operated with power transmitted from the power plant. There were very good reasons for this change of plan. Among them were these:

1. The economical and best layout dictated two separate stations, a low lift to pump the water from the river to the purification works, and a secondary lift to pump the water through the tunnels to the reservoirs at the new and existing high head stations.

2. In consequence of the above each station had a capacity of about 2500 H. P., which is comparatively small for efficient steam generation.

3. There were several small pumps such as those needed for wash water, house service, etc., which would not lend themselves to economical steam drive.

4. The chemical plant, Dorr clarifiers, and sump pumps, cranes, etc., in addition to lighting, called for a great deal of electric power.

5. Due to the low floor elevation necessary at the Low Lift station the substructure was rather expensive. Steam drive with condenser and auxiliary equipment needed a great deal more room than did electric drive.

6. The losses in generating power and transmitting it would be offset by the better efficiencies gained in a centralized steam generating plant with larger units and lower unit labor costs.

The combined pumping and electrical loads at the high lift station in the East Bottoms was between 17,000 and 20,000 H. P. The cost of this combined station was estimated at about $3,000,000. The estimated cost of the entire additional works was approximately $20,000,000, but bonds were issued for only $11,000,000. Accordingly, some means of reducing costs had to be adopted. Purchased electric power offered a solution of pumping station economies in capital investment. The rates offered by the Kansas City Power & Light Co., when figured at certain load factors, compared very favorably with costs based on steam operation. Up to the present, however, these load factors have not been attained, due to a change of plan regarding the relative amounts of water pumped by the steam station at Turkey Creek and the electric station at East Bottoms, and the resultant power rate is not as low as was figured. Correspondingly so, would operating costs at East Bottoms station for steam drive have been affected had it been adopted.

The Unique Power Contract.—Because of the fact that two local utilities competed with each other and with the consulting engineers' estimate of steam costs, a very interesting three-cornered fight ensued, with the result that the city was able to procure a contract that is unique in several ways, and rates that should result in an average cost of one cent per kilowatt hour if original load factors on electric pumpage be attained.

Some of the outstanding features of the contract are these:

1. That the city shall have first call on the power plants of the company.

2. That duplicate feeders, of very liberal capacity, shall connect the stations with the power plants by two separate and independent routes.

3. That no other consumers shall be served by these feeders.

4. That no substations shall intervene between the pumping stations and the power plant.

5. That the established demand be calculated on a monthly average of half hour peaks rather than on an individual half hour.

6. That peak demands due to large fires, or emergency due to breakage of large mains, etc., be not considered in establishing the demand charge.

7. That the peak months for water pumpage, namely, June, July and August, be not considered in establishing the maximum demand but be treated as individual months.

8. That a credit or debit be allowed or charged with the fluctuations in the cost of fuel regarding a certain price as a base.

9. That a reduction in the demand charge be made based on 80 per cent power factor. Maintenance of 100 per cent power factor reduces the demand charge by 20 per cent.

Since the city has installed synchronous motors on all its major pumping equipment it is easy to maintain 100 per cent power factor.

The following are the rates:

Demand Charge: $1.56¼ per month per kilowatt, plus $3,000 per month to cover charges on transmission lines.

Energy Charge: $0.007 per kilowatt hour until the demand at the high lift station exceeds 2,800 kilowatts; $0.00675 per kilowatt hour until the demand at the high lift station exceeds 4,250 kilowatts; $0.0065 per kilowatt hour until the demand at the high lift station exceeds 5,600 kilowatts; $0.00625 thereafter.

The life of the contract is 20 years, but it may be terminated upon the giving of due notice by the city, should the company fail to give first class service.

The Pumps.—When steam drive was considered for the high lift station, 35 M.G.D. pumps were selected, but with electric drive, using synchronous motors, the capacity was changed to 24 M.G.D. contemplating six of the latter in place of four of the former. At the low and secondary lift stations 35 M.G.D. pumps were selected. One pump in each of these latter named stations, however, is equipped with a 20 M.G.D. impeller.

On account of the wide variation in head at the low and secondary lift stations the capacities stated are obtained only at average heads. The heads at the Low Lift station vary from 18 to 51 ft., while those at the Secondary vary from 14 to 48 feet. These wide ranges of head presented quite a problem and the question of using two speed motors received considerable study. A careful examination of records of river stages covering several years of observation brought out the fact that during eighty per cent of the time the heads at the low lift station could be expected to vary between the limits of 39 and 48 ft., including suction lift. For the same percentage of the time it was found that the heads at the secondary lift station would vary between 32 and 44 ft. These estimates are based on normal operation of the works when supplying all of the needs of the city.

Synchronous Motors Used.—Based on the narrower limits of head variation, it was decided to use synchronous rather than two speed induction motors. The former had the advantage of better efficiencies during eighty per cent of the time, better power factor at all

times, less operating complications and slightly less cost; while the latter afforded better pump efficiencies for twenty per cent of the time. The power factor clause in the power contract was a determining factor in the decision.

The pumps at the low and secondary lift stations are of the double suction, single stage, volute type with 36 in. suction and 30 in. discharge nozzles. The casings are of cast iron, are split horizontally, with suction and discharge nozzles in the lower half and placed horizontally. The speed is 360 revolutions per minute. The short life of high speed impellers due to the cutting effect of the Missouri River sand was the reason for selecting such a low speed. For obvious reasons the same speed was selected for the secondary lift pumps.

Owing to the wide range of head under which these pumps were to operate, a minimum capacity of 32 M.G.D. was specified at 51 ft. total head at the low lift station and at 48 ft. total head at the secondary station. The manufatcurers were asked to produce as flat a capacity curve as possible and were given three heads at which they were to make efficiency guarantees. The following is a tabulation of results obtained in field tests and which were somewhat better than those guaranteed:

Total Head in Feet	Capacity in M.G.D.	Efficiency in Per Cent
32	44.0	80.5
38	40.5	84.0
44	36.0	86.0
48	32.1	

No efficiency guarantees were asked at 48 ft. head. The above is the result of a test on one of the pumps at the secondary lift station and is typical of all the pumps at this station. The efficiencies of the pumps at the low lift station are somewhat higher, but both the efficiency and capacity curves have the same characteristic of flatness that is peculiar to those obtained from the pumps at the other station. The pumps in which the 20 M.G.D. impellers are installed show efficiencies varying from two to three per cent lower than those of the pumps with the larger impellers. Of course the 20 M.G.D. impellers are merely a temporary measure.

The Main Pumping Equipment.—Summarizing, the main pumping equipment at the low and secondary lift stations comprises one 20 M.G.D. and three 35 M.G.D. pumps, with room for a future unit, in each station. Maximum head conditions at the low lift station occur when maximum demand and minimum river stage coincide. At the secondary lift station maximum head depends on demand, the elevations of the clear well and of the reservoirs at the high lift stations. Since at maximum heads the pump capacities are reduced to 32 M.G.D. and 18 M.G.D., the total capacity of the stations under maximum head conditions is about 114 M.G.D. It is not probable, however, that maximum demands at the low lift station will occur simultaneously with minimum river stage, for which reason this station capacity will be in excess of 114 M.G.D. during periods of maximum demand. At the secondary lift station all pumps were put on the line, the head was about 49 ft., and the total capacity of the station was 116 M.G.D.

Outside of the characteristics mentioned above there is nothing unusual about these pumps nor about their installation and method of operation. They must be started against a closed discharge valve so as to keep the "pull in" torques of the motors down to a limit where best overall motor efficiency may be obtained. The pumps are primed by vacuum pumps, of the Nash Hytor type, two in each station. Those at the secondary lift station are controlled automatically by vacuum gauges acting on the motor controllers. The piping at both stations is so arranged that one or both vacuum pumps may be used to prime any of the main pumps.

The Service Pumps.—In addition to the main pumping equipment at the secondary lift station there are three wash water and four house service pumps. The former are of 2500 G.P.M. capacity and operate against a head of 75 ft. Of the latter, two are of 500 G.P.M. and two of 250 G.P.M. capacity, all operating against 100 lb. pressure. The wash water pumps may be controlled from the filter galleries. The electrical control will be discussed later. The center lines of the pumps are at about elevation 23.0 and since the clear well is normally kept above this elevation, the pumps are normally primed. The piping is such that the pumps discharge into the wash water tanks or directly into the filters depending upon the operation of certain valves. The house service pumps supply water to a tank the average elevation of which is about 230 ft. This tank furnishes pressure water for operating valves, for fire hydrants, for domestic and other uses about the plant.

Pumping Units at East Bottoms.—The two pumps at the new high lift station, known as the East Bottoms pumping station, are of the horizontal shaft, two stage, type, consisting of two double suction, volute type pumps connected for series operation. The series piping is located under the operating floor. The casings are of semi-steel, split horizontally with suction and discharge nozzles in the lower half. Both nozzles are 20 in. in diameter, the suction pointing directly downwards and the discharge horizontally. These pumps are supposed to deliver 24 M.G.D. at 390 ft. total head while running at 720 revolutions per minute. The following is a tabulation of results obtained in field tests on one of the pumps. The other showed slightly less capacity and efficiency, but the average of both pumps met the guarantees.

Total Head in Feet	Capacity in M.G.D.	Efficiency in Per Cent
370	26.4	85.5
390	25.0	86.5
410	23.2	85.8

Since the initial installation, new 12 M.G.D. impellers have been installed in one of the pumping units. Recent field tests on this unit show the following:

Total Head in Feet	Capacity in M.G.D.	Efficiency in Per Cent
370	13.4	82.75
380	12.8	82.50
390	12.2	82.50
400	11.65	82.50

There is nothing unsuual about these pumping units. One great advantage that electric drive affords is that of the ease and speed with which a unit may be started and stopped. Normal operation provides a basin elevation that is high enough to make priming unnecessary. Omitting priming, a unit may be started and its full capacity placed on the line within 1½ minutes. The shutting down process consumes but 16 seconds, that is, from the time that the oil circuit breaker is tripped until the pump comes to rest and the check valve is closed. The sequence of operation will be discussed under the electrical features.

Since continuity of service is one of the prime requisites of the driving power for a direct pumpage system, it is necessary that the electrical layout provide sufficient duplication and flexibility to insure this service.

Electricity Supply.—The entire works in North Kansas City are fed from an outdoor sub-station which is the property of the city. Power is obtained from the Kansas City Power & Light Co., at 13,200 volts over two feeders, one overhead and the other underground. The sub-station equipment comprises two 2,500 K. V. A. banks of transformers connected delta-delta. Each transformer is rated 833 K. V. A., 13,200/2,300 volts, single phase, 60 cycles and is equipped with conservator and temperature indicator. These capacities were chosen on the basis that when overloaded 25 per cent one bank can carry 90 per cent of the ultimate load of the works.

The two incoming feeders form a loop and are protected by directional relays. The overhead line is provided with an oxide film arrester. Each bank of transformers is controlled by an oil circuit breaker on the high tension side as well as on the low tension side and is differentially protected. A tie line breaker on the high tension side provides flexibility while the low tension side is connected to a bus which is sectionalized by disconnecting switches. From this bus four feeders, two to each station, supply the low and secondary stations. Each station is fed by two feeders one from each section of the transformer low tension bus.

At this station the power is metered on the high tension side. Duplicate

sets of metering transformers, one for the company and the other for the city, are installed on the structure. Duplicate sets of meters are located on the switchboard of the Secondary station. The metering equipment consists of recording demand and power factor meters and integrating watt hour meters.

Motor Power Drive.—Each of the main pumps in the low lift station is driven by a 400 HP., unity power factor, synchronous motor operating at 2,300 volts, 3 phase, 60 cycles, 360 R. P. M. The excitation for these motors is supplied by two 30 K. W., 125 volts direct current, motor generator sets. Each set is capable of furnishing excitation for five motors. These sets may be used for lighting in case of failure of the lighting transformer.

The control for this electrical equipment comprises a fourteen panel switchboard, the material of which is asbestos board, finished in natural black. This board is mounted on the gallery floor, 28 ft. above the pump room floor. A technical remote control system through bell cranks and pull rods operate the oil circuit breakers which are supported on a pipe framework and located on another gallery 12 ft. below the switchboard floor.

The main bus is sectionalized by two oil circuit breakers. In the section between these breakers there is connected a station service feeder which serves power, lighting and heating transformers. Each outside section of the bus is fed by an incoming feeder, each having the capacity of the entire station. One section serves two motors while the other serves the remaining two motors and will serve the future unit.

Motor starting is accomplished by means of compensators and a starting bus. This bus is sectionalized by disconnecting switches, each section being connected to a compensator. Each compensator has enough capacity to permit of four starting operations within ten minutes without excessive heating of the compensator.

Auxiliary power for operating vacuum pumps, sump pumps, motor generator sets, crane and gate valves in this building as well as the revolving screens in the intake is obtained from 3-25 K. V. A., 2,300/230 volt transformers connected delta-delta. The lighting transformer is rated at 15 K. V. A., 2,300/230/115 volts.

Both the intake and the low lift stations are heated electrically and are served by a 150 K. V. A., 3 phase, 2,300/230 volt transformer. Industrial oven type, 220 volt ribbon element heaters suitably backed with reflecting and insulating material and provided with grille work in the front, are placed along the gallery in a manner similar to steam radiator practice. In most locations two elements are used to form one radiator, but they are individually controlled by local switches so that flexibility in controlling the heat may be obtained.

At the secondary lift station the main pumping equipment is a duplicate of that at the low lift station, consequently the electrical equipment is similar. The wash water pumps are driven by 75 HP., 2,300 volts, 3 phase, 60 cycles, 1,800 R. P. M. squirrel cage induction motors. They are controlled by automatic "across-the-line" contactors and push button switches. The latter are located at three different places, one at the contactor and one in each filter gallery. The latter are connected in parallel with each other and in series with that at the contactor. An oil circuit breaker controls each pump circuit. The 500 G. P. M. house service pumps are driven by 60 HP., 2,300 volts, squirrel cage induction motors which are started right across the line by merely closing the oil circuit breakers. The 250 G. P. M. house service pumps are driven by 25 HP., 220 volts motors and are controlled by starting compensators.

In addition to these pumps all the power used in the chemical house, filter house, Dorr clarifiers and the lighting for all these buildings and the grounds are controlled from the switchboard in the secondary lift station.

The Switchboard.—The switchboard comprises twenty-one panels and the system is that of mechanical remote control with the main breakers and bus located in a room on the lower floor beneath the switchboard. The starting bus with its compensators and breakers are located at the back of the switchboard. The busses are sectionalized in a manner similar to those at the low lift station, but here there is one breaker for auxiliary power and one for lighting. There is no electric heating in this building.

The auxiliary power transformers comprise 3-75 K. V. A., 2,300/230 volt units connected delta-delta. Multiple lighting is served by a 75 K. V. A., 2,300/230/115 volt transformer and series lighting by an 8 K. V. A. constant current transformer.

At the East Bottoms station the pumps are driven by 2,000 HP., 8 power factor (leading) 13,200 volts, 3 phase, 60 cycle, 720 R. P. M. synchronous motors. They are equipped with direct connected exciters which supply 125 volts to the fields. They are provided with temperature detectors of the resistance type and are equipped with enclosing end bells to cut down noise.

The switchboard comprises fourteen panels at present, but is expected to be expanded ultimately to twenty-one. The system is that of electrical remote control, some operations being performed manually while others are automatically controlled by relays and interlocks. The front of the switchboard faces the pump room while access to the back is had from the switch house. The material is asbestos board finished in natural black. All panels are of the same width, namely 24 in.

With the exception of the auxiliary bus for light and power transformers, all busses, switching equipment, instrument transformers, compensators, etc., are enclosed in a monolithic concrete cell structure, with each phase in a separate cell. The auxiliary bus is mounted on a structural steel frame work and is totally enclosed, the top and part of the sides being protected with transite board.

The station is fed by two underground lines direct from the company's power house bus. Ultimately there will be four such feeders. These feeders are installed in duct lines, each line taking a different route from the power house to the pumping station. The main bus in the station is in duplicate, but may be made one continuous bus by closing the tie breaker at one end of the bus structure.

Motor starting is accomplished by compensators and starting bus as in the other stations, but in addition "neutral" breakers are used to provide a smoother transition from starting to running voltage. Motors have 85 per cent pull in torque and full voltage is applied before the field circuit is closed.

The control circuit is fed by an MVSX Exide battery. A small motor generator set of 3 K. W. furnishes the trickle charge for the battery.

Operations in Starting a Motor.—At this point the sequence of operations in starting a motor might be interesting. First, the neutral breaker is closed manually, which automatically closes the compensator breaker. Next, the starting breaker is closed manually. An accelerating relay controls the next steps. As it closes, it trips the neutral breaker which automatically closes the running breaker. The field breaker is then closed manually and the compensator breaker tripped by hand, which operation automatically trips the starting breaker. If the field breaker be not closed within ten seconds after closure of the running breaker, the field failure trips the running breaker.

With the closing of the running breaker a solenoid valve on the automatic check valve is closed. This will be described more fully later. Due to the fact that this solenoid valve closes only after the running breaker is closed the motor "pulls in" against a closed discharge because the check valve cannot open while the solenoid valve is open.

In this station there is a 30 K. W. motor generator set which performs four important functions. It can supply excitation for any one or two of the main motors. It provides a source of direct current for lighting in case of failure of the lighting transformer. It can give a full charge to the battery. It can provide current for the control circuit while the battery is out of service or being charged.

Auxiliaries are fed from a bank of 3-25 K. V. A., 13,200/230 volt transformers. Lighting is supplied by a 25 K. V. A., 13,200/230/115 volt trans-

former. Emergency lights are fed from the battery.

Automatic Stop and Check Valve.—The description of this station would be incomplete without a word about the automatic stop and check valves. They are of the Johnson type and open and close automatically with unbalance of hydraulic conditions in the valve. The necessary unbalance of hydraulic conditions may be controlled by a solenoid operated valve in the blow off line of the main valve. The solenoid circuit is interlocked with the running breaker and a control switch on the switchboard is inserted in the circuit. With the closing of the running breaker the solenoid valve closes and permits the main valve to open as soon as the pressure on the pump side of the valve becomes greater than that on the line side. As soon as the running breaker trips out, the solenoid valve opens and the main valve closes. The control switch on the board permits the operator to open the solenoid valve circuit thereby opening the solenoid valve which in turn closes the main valve even with the pump operating at full speed. The operation of the main valve may be noted by the pressure gauge reading. This permits of the checking of one of the most important features of the station without disturbing normal operation.

The foregoing endeavors to describe, as fully as space will permit, the electrical and pumping equipment in the new works with special attention paid to the features which are unusual in waterworks practice. The use of 13,200 volt motors and electric radiators seem to be bold steps, and they are in waterworks practice, but in reality they are not new to the electrical industry.

It must be realized that when the works are put in full operation the city will be dependent entirely on electrical power for its water. Moreover, this electric power is being purchased from a public utility, namely, the Kansas City Power and Light Company. It is a great tribute to the reliability of electric public utility service and to the electrical industry as a whole. It is the writer's earnest hope that, as the years go by, no mishap will occur to shake the confidence so justifiably placed today.

Acknowledgment.—The foregoing is an abstract of a paper presented Oct. 4 before the Missouri Valley Section of the American Water Works Association.

Fatal Accident Locations on Ohio Highways.—Over 2,000 white crosses have been erected on roads in Ohio, since 1925, when the state director of highways began this method of marking the location of fatal accidents. The following table shows where the deaths have occurred.

	Per Cent
Straight sections of road	33
Railroad crossings	30
Curves or turns	18
Road intersections	7
Hills	6
Bridges	6

The Federation of Sewage Works Associations

A new technical association in the municipal field has been organized. This is the Federation of Sewage Works Associations. Its organization and purposes are set forth as follows by Chas. A. Emerson, Jr., chairman of the Federation in the first issue of its official publication, "Sewage Works Journal," issued last month.

"At the present time workers in the various branches of the sewage field, including operators of sewage and industrial waste treatment plants, scientists engaged in research, and municipal and private engineers interested in design and construction, are meeting annually in a number of our states for discussion of problems of mutual interest. These groups are known as sewage works associations, sewage and waste disposal conferences, and schools of instruction for water and sewage works operators. That the meetings are of real value to the participants is evidenced by the gradual spread of the movement; in fact, local sewage associations have been organized in two of our far western states during the past few weeks, and are being actively considered in at least four other states.

"It requires but slight imagination to forecast the formation within a very few years of state and district sewage works associations throughout the land, so that each worker may have the advantage of listening to papers and taking part in discussions with a minimum amount of expense for travel.

"Raising funds for publication of papers and discussions presented at these meetings has been a serious problem in all but one or two instances and resort to various expedients has been necessary.

"Sometimes a state department or a state university has issued the proceedings as a bulletin, and in other cases publication has been due to the generosity of business men's associations, or to a small group of manufacturers of sewage treatment plant supplies and equipment. Some associations have not been able to issue proceedings and no record has been made of contributions, presumably of considerable value.

"At the best, these proceedings have had a limited circulation, usually reaching only the members of the particular local association, even though the papers may have been of national interest and importance.

"In order for one person to receive the benefit of papers and discussions presented at all of these local associations, it would be necessary, under existing conditions, to pay dues in each and to attend meetings in various parts of the country, entailing an expenditure beyond the means of the majority.

"Ways and means for strengthening existing local organizations, for formation of others over a wider geographical range, and for providing a wide circulation of the papers presented at the various meetings so as to reach all interested workers at a minimum expense to the individual, have been widely discussed during the past two years. Other matters needing correction are the paucity of reliable and comparable data concerning operation of treatment plants; a lack of suitable outlets for sewage research papers, and wasted effort through presentation of practically identical papers at several different meetings.

"Workers interested in the solution of these problems have met in informal discussions held in connection with conventions of the American Society of Civil Engineers, the American Water Works Association, and the American Public Health Association. A committee of one hundred members, representing every section of the country, studied for several months, and, after rendering a preliminary report, gave way to four small committees working under a general chairman.

"Conclusions reached and recommendations made during this painstaking study were:

"1. That a national sewage works association with an annual meeting would be undesirable at present, because the expense for travel to an annual convention would be generally prohibitive.

"2. That desired results could best be obtained by strengthening the existing local sewage works associations and by the formation of others in each state, or in groups of two or three states taken as a unit, so that workers could attend meetings at minimum expense.

"3. That the local associations should be joined into a country-wide Federation and be guided by representatives selected by each of the local groups to act as a central board of direction.

"4. That a journal should be published by the Federation containing important papers presented at all the local meetings, together with proceedings of the meetings and original research articles for distribution to every member of each local association at a moderate price.

"As such a Federation was intended purely as a mutual benefit association, it was mandatory that arrangements be made to bring the costs within the means of all who might be interested. The publication of such a journal would be a matter of great expense and could not be entirely placed upon the member associations. For the solution of this financial problem appeals were made to a group of manufacturers of sewage works equipment and to The Chemical Foundation. Through their practical interest and generosity, together with the expenditure of much time and effort by individuals throughout the country, the Federation of Sewage Works Associations has been effected and the publication of the journal has become possible."

Sewage Treatment Plant at Grand Canyon National Park

Details of One of Most Interesting Plants in This Country

By H. B. HOMMON

Sanitary Engineer, U. S. Public Health Service, in Charge of Sanitation in the National Parks

THE Grand Canyon National Park, created by act of Congress, Feb. 26, 1919, is one of the 19 national parks administered by the National Park Service, under the Department of the Interior. It lies in the northern part of Arizona and has an area of 958 square miles. Within this area the Colorado River flows through 56 miles of gorge or canyon which is over a mile deep and 20 miles wide at the top in places. The park derived its name from this canyon. Most of the visitors to the park have, in the past, gone to the south rim, where there are hotels, stores, and an automobile camp. The data given in this paper refer to sewage disposal at the south rim. An extensive building and development program is now under way on the north rim, but up to the present time only a comparatively few people have ever visited the territory in the park to the north of the Colorado River.

Water Supply.—The water supply for the south rim, furnished by the Santa Fe R. R. Co., is ordinarily hauled in tank cars from Flagstaff, Ariz., a distance of about 100 miles. When this supply becomes low, water is obtained from Puro, Ariz., which is about 120 miles from the canyon. The cost of bringing in water from Flagstaff is $3.09 per 1,000 gal., and the amount delivered during the peak of the tourist season, when there are approximately 2,400 people in the park, averages about 100,000 gal. daily.

The only sources of water supplies in the territory around the south rim are (1) the San Francisco Mountains, about 52 miles away; (2) Bright Angel Creek, about 6 miles away and at about 5,000 ft. lower elevation; (3) some springs approximately 2 miles distant and about 3,500 ft. below the rim of the canyon; and (4) the Colorado River. No attempt has ever been made to develop either of the first two sources, on account of the cost, and the spring supply has been in litigation until recently. The Colorado River has not been considered as a source of supply on account of the high turbidity of the water throughout the year at the place where a pumping plant could be installed, and because of the expense of a 6-mile pipe line and the cost of raising the water approximately 5,000 ft.

Sewage Disposal.—When the Santa Fe R. R. Co. began extensive developments at the south rim, before the Grand Canyon National Park was created, a sewage treatment plant, consisting of septic tanks, contact filters, and pressure sand filter, was constructed to treat the sewage so that the effluent could be used for irrigating lawns and for boiler purposes. The effluent, however, was always putrescible, contained hydrogen sulphide and could not be used for irrigating lawns near the hotel, and it was not satisfactory for boiler purposes. There was also a decided odor in the vicinity of the plant. The laundry waste caused foaming in the boilers, and was bypassed around the treatment plant.

In 1924 the number of visitors to the park had increased to such an extent that it was necessary to make extensive improvements to the railroad terminal

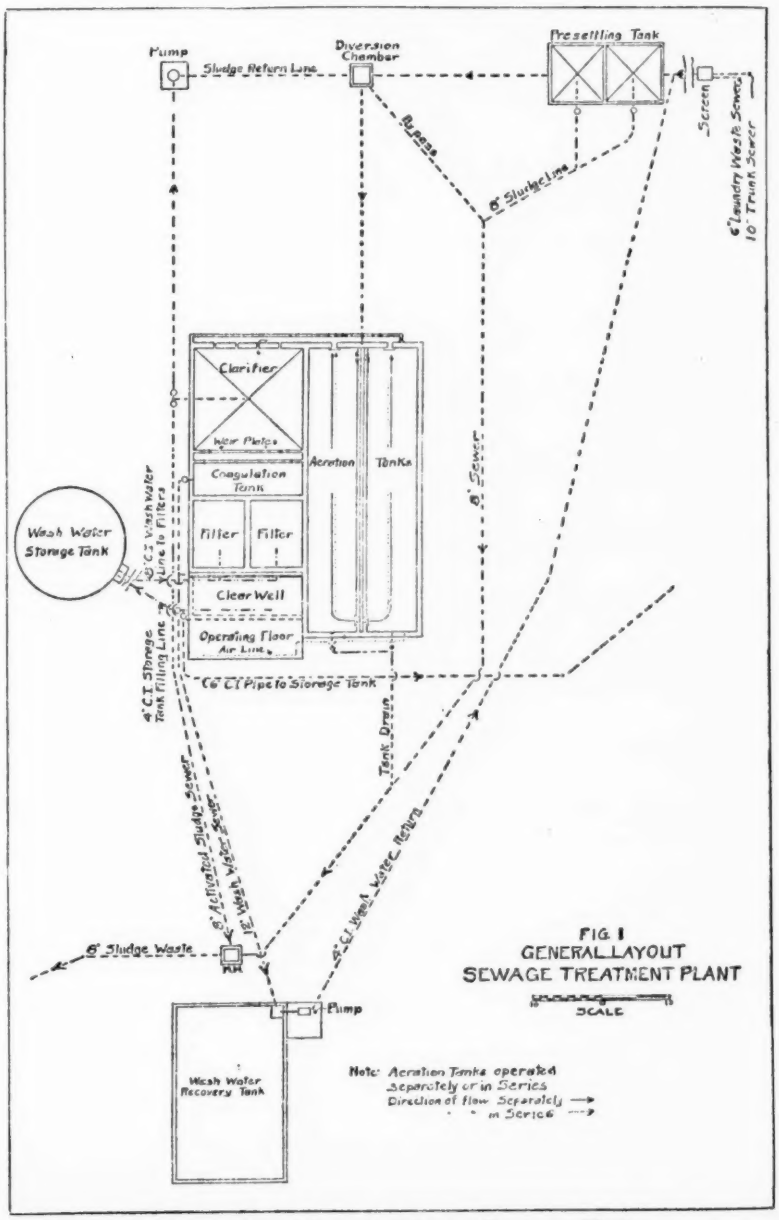


Fig. 1.—General Layout of Sewage Treatment Plant

Fig. 2.—General View of Sewage Treatment Plant. (1) Wash Water Return Line; (2) Presettling Tank; (3) Diversion Chamber; (4) Valve in Line From Air Channel; (5) Aeration tanks; (6) Clarifier; (7) House Over Sand Filters, Clear Well, Pumps and Motors

facilities, improve the roads, and adopt a comprehensive development plan for hotels, residences, stores, garages, etc., to take care of the visitors and employees. The problem of supplying water for the increased population was acute, and in the general plan worked out for major improvements there was included a new sewerage system and a sewage treatment plant that would purify the sewage so that it could be used for as many purposes as possible in place of fresh water.

On account of the troubles experienced in using the effluent from the old treatment plant in boilers, when the laundry waste was treated along with the domestic sewage, a separate sewer line was included in the design of the sewerage system to carry the laundry waste to the by-pass around the treatment plant.

Treatment Plant.—Since it was desired to purify the sewage so it could be used in place of fresh water, for certain purposes, methods of treatment were considered which would produce, consistently, the highest quality of effluent under the climatic and other conditions at the canyon. Settling tanks, slow sand filters, and sterilization would produce a satisfactory effluent, but the high cost of sand (approximately $7 per yard) and the difficulties of operation during the winter at an elevation of 6,800 ft., made this method impractical. Settling tanks, sprinkling filters, slow sand filters, and sterilization would also produce an effluent of the highest quality, but the high cost of materials and the severe winters precluded the adoption of this method. There remained, therefore, the activated sludge process, rapid sand filters, and sterilization as the method which could be operated with the least difficulties in the winter, which would produce throughout the year an effluent of the quality desired, and would require the smallest amount of material to be shipped to the canyon. In the following paragraphs there is given a description of the treatment devices installed. The layout of the plant is shown in Fig. 1, and a general view in Fig. 2.

Screen.—A coarse bar screen is located in a screen chamber on the trunk sewer line near the inlet to the presettling tank. It is 3 ft. wide by 3 ft. deep and has ⅜-in. by 2-in. rectangular iron bars spaced 2⅜-in. on centers. The bars are embedded in concrete at the top and bottom, and slope in the direction of flow of the sewage at an angle of 30°.

Presettling Tank.—Since it was essential that an effluent be obtained of the highest possible quality, and there was some uncertainty as to how the strong domestic sewage would react to the activated sludge treatment, it seemed advisable to install a presettling tank for the purpose of removing as much of the fresh fecal matter and other coarse material as practicable. The tank was designed for a detention period of 30 minutes at the time of maximum flow. It has hopper bottoms, and the sludge is discharged by gravity into the by-pass around the plant. The tank has two sewage outlet pipes, one of which is level with the top of the hoppers and leads to the aeration tanks while the other is near the top of the tank and connects with the lower pipe. This tank, as will be explained later, is also used to store a part of the night flow of sewage.

Diversion Chamber.—This is a small chamber located on the line from the presettling tank to the aeration tank for the purpose of by-passing the sewage, when necessary, around the treatment plant.

Aeration Tanks.—There are two tanks, each 42 ft. by 8 ft. by 10 ft. deep below the water level, and they were designed to treat approximately 200,000 gal. of sewage daily with an average aeration period of six hours. The design of the tanks is shown in Fig. 4. In each tank there are two continuous concrete air channels, each 42 ft. lon by 11 in. wide by 5½ in. deep. Filtros plates, 12 in. by 12 in. by 1½ in. thick, were grouted into the top of the side walls of the channels, and into T-irons, 2½ in. by 1¼ in. and 2.87 lb. per foot across the channels, as shown in Fig. 5. The air channels at both ends of the tanks have 4-in. pipes that extend through the concrete walls about 2 ft., and on the end of each pipe there is a 4-in. gate valve. These pipes and valves were installed for the purpose of cleaning out the air channels and to permit cleaning the under surfaces of the plates if they should become clogged. The air is applied to the 4-in. pipe at the ends of the tanks nearest the blowers, as shown in Fig. 3. At the opposite ends, 2-in. pipes connected to the 4-in. pipes between the valves and the tank walls lead upwards and over the walls into the tank. The 2-in. pipes were installed in order that the sewage which accumulates in the air channels when the plant is closed down can be blown up into the tanks instead of through the plates.

No difficulties were encountered in placing the filtros plates over the channels, and there has been no leakage of air around the plates. There was, however, leakage through a short section of one of the ridges of one tank when the plant was first placed in operation, but the leak was easily repaired.

The two tanks are separated by a wall that has at the top a channel which receives the raw sewage from the presettling tank. By means of a stop gate in the channel, the sewage is discharged into the end of one tank and flows out through an opening in the partition wall at the farther end into the other tank and through it to the effluent channel. If it is desired to use only one tank, the sewage is carried in the channel in the top of the partition wall to the farther end of the tanks where it is discharged into either tank and flows back to the effluent channel.

Clarifier.—This tank is 16 ft. square and 11½ ft. deep and is provided with a scraping device that concentrates the sludge at an outlet pipe in the center. It has a detention period of approximately 2.8 hours with the present flow of sewage, assuming that most of the sewage reaches the plant during 14 hours.

The effluent of the activated sludge tanks enters the clarifier through four openings spaced equally apart along one side and about 1 ft. below the surface of the sewage. The effluent flows out over a brass weir plate into a channel that leads to the end of a small secondary settling tank.

Secondary Settling Tank.—The secondary settling tank is 16 ft. by 4 ft. by 10 ft. deep, and was originally designed as a coagulation basin to be used in connection with the operation of the rapid sand filters. It was found, however, that it was not necessary to use

coagulants, and the tank has been used to settle the effluent from the clarifier. An appreciable amount of solids is removed by this tank, and the sludge is discharged through 1-in. openings spaced 1 ft. apart in an 8-in. pipe that extends the full length of the bottom of the tank.

Rapid Sand Filters.—Two filter units were designed, each having an area of 77 sq. ft. Concrete wash-water troughs were provided, and the underdrainage consists of 12-in. headers with 1¼-in. cast-iron laterals having ¼-in. holes bored on 3-in. centers. The specifications for the coarse sand and gravel were as follows:

8 in. gravel passing 2½-in. mesh screen and retained on 1½-in. mesh.
4 in. gravel passing 1½-in. mesh screen and retained on ¾-in. mesh.
4 in. gravel passing ¾-in. mesh screen and retained on ¼-in. mesh.
4 in. gravel passing ¼-in. mesh screen and retained on 1/12 in. mesh.

On account of the lack of data regarding the size of sand for rapid sand filters filtering sewage, there was ordered for filter No. 1 a sand having an effective size of 0.35 millimeters and a uniformity coefficient of 1.6, and for filter No. 2 a sand with an effective size of 0.40 millimeters and a uniformity coefficient of 1.6.

Although the sand and gravel delivered were marked in accordance with the specifications, it was found later, when difficulties were experienced in operating the filters, that the sand in filters No. 1 and No. 2 had effective sizes of 0.34 millimeters and 0.23 millimeters and uniformity coefficient of 1.29 and 1.48, respectively.

Loss of head gauges and rate controllers and other equipment were installed so that the filters could be operated in accordance with common practice in water-filtration plants.

Wash-Water Tank.—Water is delivered to the wash-water tank through a 4-in. pipe line connected to the reclaimed sewage force main, and the flow is regulated by an altitude valve. An 8-in. pipe supplies wash water for the filters.

Clear Well.—The clear well is 16 ft. square and 5½ ft. deep below the overflow. The capacity is 10,500 gal., but in practice the automatic floats start the pumps in operation when the sewage reaches about one foot below the overflow.

Pumping Equipment.—The reclaimed sewage is pumped to a steel storage tank by two 4-in. vertical centrifugal pumps which are operated by vertical motors. The tank sets level with the ground and has a capacity of 200,000 gal. The operation of the pumps is controlled by automatic float switches.

Blowers.—One air compressor with rotor revolving in water, which washes the air, was installed originally and a duplicate unit added a year later. The capacity of each of these units is 200 cu. ft. per minute.

Sterilizing Equipment.—A semiautomatic chlorine machine is used for applying liquid chlorine to the reclaimed sewage. When either of the pumps start operating, the force of the current in the main moves a vane hanging in the line, and this in turn opens a valve on the chlorine machine that permits chlorine dissolved in water to flow into the clear well at the combined suction of the pumps. When the pumps stop operating the vane falls back to a vertical position and shuts off the chlorine.

In addition to the liquid chlorine machine there is standard equipment for using sodium hypochlorite solution for sterilizing the filter effluents when for any reason liquid chlorine can not be applied. Sodium hypochlorite solution is kept on hand in 5-gal. jugs and everything is ready for use in an emergency.

Wash Water Recovery Tank.—Since every 1,000 gal. of reclaimed sewage that can be used in the place of fresh water is worth $3.09, a settling tank was installed to collect the wash water from the filters. This tank is 25 ft. by 16 ft. by 4½ ft., deep below the overflow. The capacity is 13,500 gal., and this is sufficient to store the wash water and permit it to be pumped back to the presettling tank at a low rate over a period of several hours.

Operation Data.—Sewage was turned into the treatment plant the latter part of June, 1926, and the effluent was pumped to the storage tank the next day. At first only one aeration tank was used and a fairly satisfactory floc developed within a few days. The floc did not settle out in the clarifier, however, and later there was trouble in keeping the floc down in the tank. As a result the filters clogged quickly. After two months a floc developed which settled in the clarifier, and since then there has been no trouble of a serious nature in operating the plant.

Much of the fine sand has been lost in washing the filters, and new sand has been ordered with an effective size of 0.40 millimeters and a uniformity coefficient of 1.6 for both filters. The coarser sand should give much higher rates.

In Table 1 there are given the more important data pertaining to the operation of the sand filters, aeration tanks, and sterilization of the filter effluent, from May, 1927, to March 31, 1928.

The only sewage lost is that mixed with the sludge drawn off from the presettling tank (600 gal. daily) and the activated sludge that accumulates in excess of the amount required for the operation of the aeration tanks. The total volume of activated sludge wasted per month on the average is about 20,000 gal.

From the first of May, 1927, to the end of November, 1927, 98.5 per cent of the sewage was reclaimed; and since December, the laundry waste amounting to 7,000 gal. daily during the winter and 10,000 gal. in the summer, has been mixed with the sewage and recovered.

As already stated the air supply lines connect with the four 42-ft. air channels under the filtros plates. When the blower is closed down, the sewage filters through the plates and fills the channels. When the air is turned on again, the valves on the 2-in. blow-out lines are opened and the sewage is blown through the pipes into the tank. By this method of operation no sewage is forced back through the plates. The sewage can be blown back through the plates, however, and this has been done frequently. It requires less than one minute to free the channels of sewage after the air pressure is turned into them. The initial air pressure on the channels was 5 lb. per square inch; and after operation of the plant for almost two years, it is only 5½ lb.

The average amount of air used, approximately 4.6 cu. ft. per gallon, for the period covering 11 months, was no doubt more than was required, but it was the normal output of the blower and there would have been no economy in reducing the volume. The aeration period, about 11½ hours, was longer than necessary to produce a satisfactory floc and stable effluent, but the

Table 1.—Data Pertaining to Operation of Sand Filters, Aeration Tanks and Sterilization[1]

Month, 1927-28	Net rate m.g.a.d. for Filter No. —[2] 1	2	Per cent wash water Filter No. — 1	2	Period between washings (hours) Filter No. — 1	2	Flow raw sewage, 1,000 gallons	Reclaimed sewage, 1,000 gallons[3]	Amount of air used per gallon, each tank	Aeration period, hours each tank	Chlorine parts per million Added	Residual at plant
May	20.6	20.6	3.7	3.5	32	32	73	72	....	....	3.6	0.4
June	23.0	23.0	3.4	3.8	50	32	83	81	2.1	5.5	3.6	.4
July	23.9	23.9	2.8	5 0	63	36	85	84	2.0	5.3	3.6	.5
August	24.4	24.4	3.3	3.8	68	53	88	86	2.1	5.1	3 2	.4
September	23.5	23.5	3 5	3.9	64	59	83	82	2.2	5.5	3.7	.5
October	21.0	21.0	3.8	4.2	50	41	75	74	3.0	6.1	4.0	.4
November	22.2	22.2	2.3	2.1	54	59	80	78	2.2	5.6	3.5	.5
December	21.1	21.1	3 8	4 1	47	44	76	75	2.5	6.0	2.7	.5
January	20.5	20.0	2.8	2.5	47	51	73	72	2.4	6.1	2.6	.5
February	21.6	21.6	3.7	3.3	38	39	77	76	2.4	5.8	1.9	.5
March	21.9	21.9	3.3	2.8	49	57	77	76	2.1	5.8	2.3	.5

[1]The figures in the table represent averages of daily records.
[2]Sand practically same size in both filters. This is due to returning to the filters sand lost in washing.
[3]Volume of reclaimed sewage was obtained by meter on force main; that of raw sewage by computation.

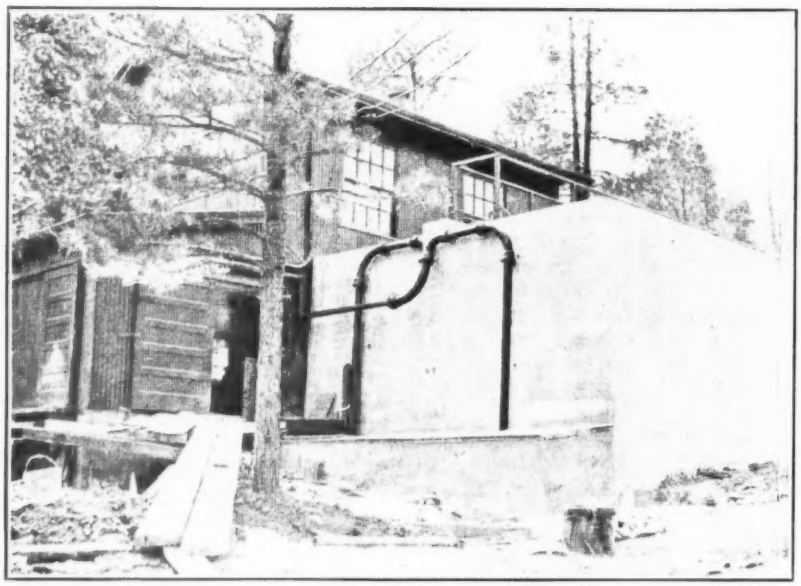


Fig. 3.—Air Supply Pipe to Channels Under Filtros Plates

tank capacity was available and it seemed advisable to use it. It is believed that the present tanks and one blower will treat twice the volume of sewage now received at the plant.

An excess of about 0.5 parts per million of free chlorine has been carried in the force main at all times to insure complete sterilization of the reclaimed sewage in the storage tank.

There is an operator in charge of the plant from 7 in the morning until 10 at night. Just before 10 p. m. the sewage in the presettling tank is drawn down to the hoppers and the sludge wasted, and the clear well is pumped out. The blower and aeration tanks operate throughout the night, but generally there is not enough sewage flowing between 10 p. m. and 7 a. m. to fill the presettling tank and clear well. This method of operating the plant has proved entirely satisfactory and saves the labor of one man.

The aeration tanks give most satisfactory results when they contain about 25 per cent of activated sludge. Sludge is returned from the clarifier to the diversion chamber ahead of the aeration tanks by an air lift.

Chemical Analyses.—A complete chemical laboratory was installed in April, 1927. The monthly average results of analyses of sewage and effluents for 11 months are given in Table II.

In comparison with the averages of results given in Public Health Bulletin No. 132, "Sewage Treatment in the United States," the settleable solids, suspended matter, and oxygen demand results of analyses of raw sewage at the canyon were, respectively, 278, 23, and 232 per cent stronger than the averages for the 15 cities given in the Bulletin. The suspended matter in the sand filter effluent at the canyon was consistently below five parts per million, the nitrates were high, and the oxygen demand was below two parts per million. The oxygen demand of the effluents of the aeration tanks and clarifier was likewise uniformly less than two parts per million. The dissolved oxygen was low; and this is explained in part by the fact that at the elevation of the treatment plant (6,866 feet) the solubility of oxygen in water is about 30 per cent less than at sea level. The relative stability of the effluents from the filters and clarifier by the methylene blue test was in every analysis more than 90 per cent.

There is practically no permanent hardness in the sewage at the canyon, and up to the time the laundry waste was treated at the plant, December, 1927, the average of 185 determinations of alkalinity was 190 parts per million, and for the same number of analyses of the effluent of the clarifier and the sand filters, the averages were, respectively, 29 and 27 parts per million. The effect of the laundry waste on the effluent is discussed later in this paper.

In Public Health Bulletin No. 132, page 13, Table No. 6, there are given the changes in the alkalinity of different sewages on passing through oxidizing devices. The sprinkling filters at Fitchburg reduced the alkalinity from 99 to 8 parts per million; those at Baltimore, 144 to 63; Reading, Pa., 177 to 105; Rochester (Brighton plant), 189 to 131; Lexington, 194 to 152; Atlanta (Intrenchment Creek plant), 82 to 48; Atlanta (Peachtree plant), 69 to 35; and Columbus, 219 to 192. The contact filters at Alliance reduced the alkalinity from 194 to 167, while similar filters at Canton showed an increase of 11 parts per million. The activated sludge plant at Houston (south side) reduced the alkalinity from 304 to 220, and the north side plant, 270 to 198; at San Marcos, Tex., the reduction was from 311 to 239; and at Sherman, Tex., the alkalinity of the effluent was 416, and of the sewage, 415. The reduction of the alkalinity in each plant was almost directly in proportion to the degree of purification effected. At Fitchburg, for example, where 92 per cent of the alkalinity of the sewage was removed by the sprinkling filters, the nitrification was higher and the oxygen demand lower than at any of the other filter plants. The effluent from the activated sludge plant at Sherman, Tex., which was the poorest of all the effluents examined from activated sludge plants, had practically the same alkalinity as the raw sewage. The plant at the Grand Canyon removed 86 per cent of the alkalinity before the laundry waste was treated with the sewage, and 80 per cent afterwards.

In view of the fact that the oxidizing processes of sewage-treatment plants, when producing a high quality of effluent, reduce the alkalinity somewhat in proportion to the extent of oxidation

Table II.—Monthly Average Results of Analyses of Sewage and Effluents[1]

Month, 1927-28	Suspended matter, parts per million			Settleable solids, c. c. per liter, 1 hour		Nitrogen in clear well as—			Dissolved oxygen, parts per million (clear well)	Oxygen demand (5 day), parts per million				Relative stability by methylene blue test (per cent)		Alkalinity as $CaCO_3$ by M. O., parts per million		
	R	C	CW	R	C	NH_3	NO_2	NO_3		R	AS	C	CW	CW	C	R	C	CW
1927																		
May	259	.....	4.3	12.0	Tr.	0.56	.....	5.6	3.2	.....	....	....	1.8	90+	90+	185	....	24
June	244	6.0	3.5	9.1	Tr.	.60	0.33	7.3	3.3	366	0.8	1.5	1.7	90+	90+	169	19	20
July	283	9.0	3.3	13.0	Tr.	.50	.70	5.8	4.1	487	1.3	1.9	1.6	90+	90+	187	27	24
August	292	6.0	3.0	10.0	Tr.	.53	.90	4.5	3.8	437	1.6	1.7	1.6	90+	90+	191	39	37
September	211	8.0	3.0	9.0	Tr.	.54	.77	3.0	4.0	380	1.1	1.3	1.0	90+	90+	209	38	34
October	225	5.0	3.0	11.0	Tr.	.45	.63	4.9	4.4	406	1.3	1.5	1.3	90+	90+	217	22	20
November	210	5.0	3.0	7.5	Tr.	.60	1.40	4.4	5.0	390	1.1	1.4	1.4	90+	90+	176	30	28
December	214	6.0	3.0	9.7	Tr.	.63	1.00	4.8	5.0	420	1.1	1.3	1.1	90+	90+	163	51	48
1928																		
January	201	10.0	5.0	10.0	Tr.	.58	.38	7.0	4.7	403	2.5	2.7	2.3	90+	90+	166	50	51
February	193	7.3	3.4	12.0	Tr.	.62	.32	7.0	4.5	388	1.6	1.7	1.6	90+	90+	172	87	86
March	207	7.0	4.0	11.0	Tr.	.39	.48	7.1	4.8	351	1.6	1.7	1.6	90+	90+	204	81	81
N	127	119	124	289	210	87	68	87	284	52	51	52	279	307	306	296	268	296

[1]Composite samples.

Note.—R = Raw sewage; C = Clarifier; CW = Clear well; AS = Activated sludge tank effluent after settling 30 minutes; N = Number analyses made.

of the organic matter, it is but reasonable to assume that the reduction is associated with the biological activity of the oxidizing devices. This relation, if better understood, might possibly throw more light on the problem of sewage treatment.

The pH value of the raw sewage and activated sludge at the canyon averages 7.0, and the final effluent, 6.3.

Bacteriological Results.—Routine bacteriological analyses have been made weekly at the treatment plant since Jan. 1, 1928. A summary of the results is given in Table III.

The results given in the table show that 99.98 per cent of the bacteria in sewage growing on agar, 24 hours, 37° C., were removed by the treatment plant, and that 99.84 per cent of the *B. coli* in the raw sewage were removed by the aeration tanks and clarifier, and 99.99 per cent by the plant as a whole. Out of the 70 portions of 10-cubic-centimeter samples of the sterilized effluent analyzed, only one was positive for *B. coli.*

Before the bacteriological work was started at the plant, 41 samples of the reclaimed sewage were sent to the Arizona State Board of Health for analysis. Of these, 28 were taken from the force main to the storage tank. The analyses showed that only five of the one hundred and forty 10-cubic-centimeter portions were positive for *B. coli,* and all these portions were from one sample. Thirteen samples were taken from a tap on the reclaimed sewage distribution line in the power house. In one sample all five 10-cubic-centimeter portions were positive for *B. coli,* and in one other sample one portion was positive. All other results were negative.

Since June, 1926, there has been made a total of 55 analyses of samples of the sterilized effluent collected from the force main to the storage tank and from a tap in the claimed sewage line in the power house, and five portions of 10 cubic centimeters each were analyzed from each sample. There were, therefore, 275 portions tested. Of these portions, 12, or 4.4 per cent, were positive for *B. coli.* It is believed that these results represent the average quality of the effluent for the entire time the treatment plant has been operated.

Table III.—Summary of Bacteriological Analyses
(Period covered by analyses, Jan. 1 to Mar. 31, 1928)

Total Count on Agar, 24 Hours, 37°C.	
Raw sewage, average 14 analyses	810,000
Aeration tank, average 4 analyses	28,000
Effluent sand filters, average 14 analyses	103
Sterilized effluent in force main, average 14 analyses	2
B. Coli	
(1) Raw sewage:	
Number per c.c., average 14 analyses	220,000
Number samples having 1,000 per c.c.	1
Number samples having 10,000 per c.c.	11
Number samples having 100,000 per c.c.	2
(2) Effluent, clarifier:	
Number samples having less than 100 per c.c.	1
Number samples having 100 per c.c.	10
Number samples having 1,000 per c.c.	4
(3) Effluent, sand filters:	
Number samples having less than 1 per c.c.	8
Number samples having 1 per c.c.	6
(4) Sterilized effluent delivered to storage tank:	
Number 10 c.c. portions tested	70
Number 10 c.c. portions negative	69

Table IV

	Raw waste	Treated waste
Oxygen demand, five days, parts per million	97	25
Suspended matter, parts per million	221	12
Total solids, parts per million	1,061	864
Alkalinity, parts per million	249	50
Phenol alkalinity, parts per million	7	0
Noncarbonate hardness, parts per million	0	0

Recovery of Laundry Wastes.—After the treatment plant had been in operation for a few months and was producing a satisfactory effluent, an investigation was made to determine how the laundry waste could be treated so that it could be recovered along with the sewage and not interfere with the use of the reclaimed sewage for generating steam. The investigation included chemical precipitation using alum in amounts varying from 10 to 35 grains per gallon. The smallest amount of alum giving satisfactory results was 15 grains per gallon. The averages of the analyses of the compositite waste untreated and treated with 15 grains per gallon are given in Table IV.

The reduction of the alkalinity from 249 to 50 parts per million by using 15 grains of alum per gallon is not in accordance with the reduction found in water treatment plants. The only explanation that can be offered for the reduction of 13 parts per million per grain of alum used is that the untreated laundry waste contained in suspension insoluble precipitates which reacted with the acid of the standard solution, whereas with the treated samples only the clear supernatant fluid which was free of suspended matter, was titrated.

Since the analyses showed that the hardness of the laundry waste was due to carbonates and bicarbonates, and 86 per cent of these constituents was removed from the sewage in the treatment plant, it was not considered necessary to treat the waste. It was mixed with the sewage and treated at the plant beginning December, 1927. The total hardness of the combined sewage and waste after treatment was determined hourly by the soap method for eight days during the hours the waste was passing through the plant. The analyses varied from a minimum of 23 to a maximum of 37 parts per million, with an average of 34. This average is slightly above that for the treated sewage before the waste was added. The monthly average results of soap hardness of the final effluent for January, February, and March were, respectively, 24, 38, and 47 parts per million, while the alkalinity results for the final effluent for the three months were 56, 86, and 81. The higher results for alkalinity were due to the presence in the laundry waste of sodium carbonate, which effects the alkalinity but not the soap hardness.

The suspended matter in the laundry waste was about the same as that in the raw sewage and the oxygen demand about one-fourth.

With the recovery of the laundry waste the amount of reclaimed sewage approaches very closely to 99 per cent of all the water discharged into the sewers.

Uses of the Reclaimed Sewage.—At the present time the reclaimed sewage is used in stationary boilers for generating steam for heating purposes, and in the locomotives that haul passengers and freight trains on the branch line of the Santa Fe from Williams to the canyon; for cooling water for Diesel engines; for irrigating lawns around the hotel; and for flushing toilets in the public comfort stations in the El Tovar Hotel, Bright Angel Camp, railroad depot and the Government automobile camp.

The force main from the treatment plant runs direct to the storage tank with only one branch taken off to supply cooling water for Diesel engines. The entire distribution system from the storage tank is inclosed in vitrified pipes up to the outlets or fixtures where the reclaimed sewage is used. Beyond the vitrified pipe the uncovered distribution lines are painted red. The sewer pipe will prevent cross connections to fresh water lines. The pressure on the fresh water mains is greater than that on the reclaimed sewage lines. No valves, spigots, or any other openings are permitted on reclaimed sewage lines except where absolutely necessary. Accurate maps are kept up to date showing all the fresh water and reclaimed sewage pipe lines and no extensions or alterations of either piping system can be made without the approval of the superintendent of the park. With these limitations and precautions in distributing the reclaimed sewage, and the careful supervision given to the operation of the treatment plant, it is believed that it will be possible to use the reclaimed sewage indefinitely without any danger to the health of visitors to the park or of employees.

There has been no criticism by employees at the canyon who use the reclaimed sewage for generating steam or for any other purposes. The locomotive engineers vigorously opposed the use of "sewage" in passenger engines at first, but after demonstration by an expert engineer they used the reclaimed sewage and found that it produced less scale than the fresh water obtained at the canyon.

All the reclaimed sewage is now being used for the purposes named above, and no others will be permitted, except possibly the washing of automobiles, under certain restrictions.

The treatment plant is operated un-

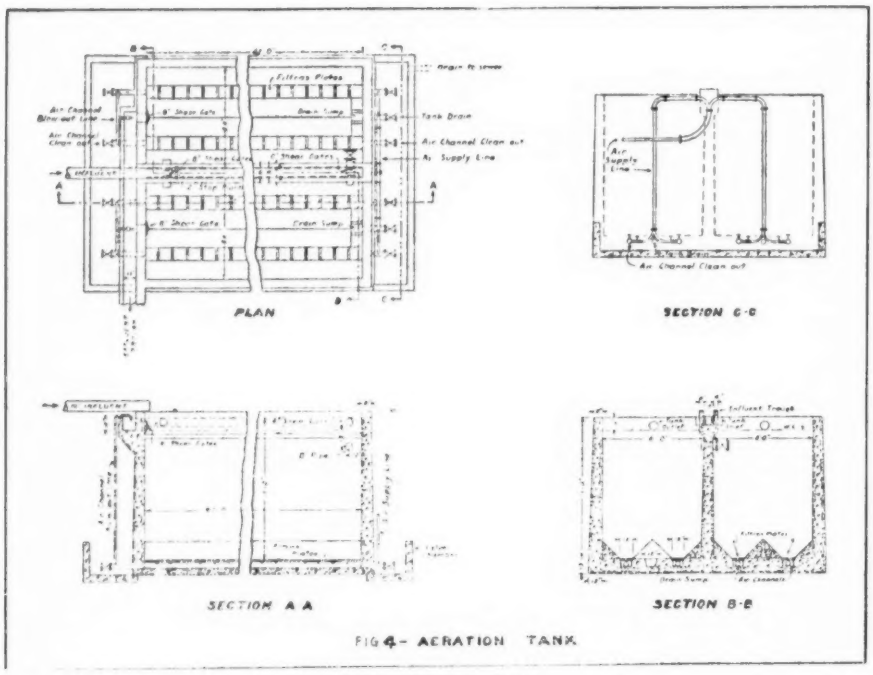


Fig. 4.—Aeration Tank

der the supervision of a competent sanitary engineer who has two trained assistants.

Cost of Operation.—In considering the cost of operation, the fact should be kept in mind that the plant was designed and is operated to produce an effluent of the same degree of purity from a bacteriological standpoint as drinking water, and that every 1,000 gal. of reclaimed sewage that can be used in place of fresh water is worth $3.09. The cost data, therefore, should be considered in relation to water filtration rather than sewage disposal.

The average volume of sewage reclaimed daily during 1927 was 79,000 gal., and the itemized cost of treatment per 1,000 gal., was approximately as follows:

Electric current at 5 ct. per kilowatt:	
Operating blower	$0.20
Returning wash water	.003
Operating clarifier	.01
Lighting	.003
Labor for operating plant:	
2 operators and sanitary engineer	.177
Liquid chlorine, oil, grease, repairs to equipment, and extra labor	.009
Interest on investment[1] (treatment plant only)	.086
Depreciation[1] (treatment plant only)	.086
	.574

These costs would be reduced approximately one-half if the plant were operating at the capacity for which it was designed and if electric current were available at the commercial rate charged in cities; and the labor cost would decrease materially for plants treating large volumes of sewage.

Conclusions.—The experience at the canyon has proved that it is possible to produce, continuously, a sewage effluent of the same quality as drinking water, in so far as bacteriological results are concerned, and of better quality than the original water for generating steam.

It is believed that where there is a scarcity of water, particularly in the West and Southwest, it will be economically practicable to reclaim sewage for industrial purposes, and for irrigating any kind of crops without danger of contaminating ground water or the products grown. The same degree of purification, however, will not be required for sewage to be used for irrigation as for industrial purposes, but sterilization will be necessary for reclaimed sewage used in growing vegetables and some other crops. The cost per acre-foot for sterilizing a well-oxidized effluent such as that produced by an activated sludge plant will be approximately $1.20 for small treatment plants using small cylinders of chlorine, and $0.60 for large plants using one-ton containers. The cost for operation of treatment plants will depend on the volume of sewage treated and the prices for labor and materials and for electric current where the activated sludge process is used. Where sewage is reclaimed for industrial purposes or for irrigation, a part of the operating expenses should logically be charged against the municipalities for disposal of the sewage, and the remainder paid by the parties benefiting by the use of the reclaimed sewage.

No municipality or private corporation should attempt to design a treatment plant to reclaim sewage without the assistance of a competent sanitary engineer, and every plant constructed should be under the supervision of a competent operator.

The treatment plant was designed by the writer, assisted by L. D. Mars, formerly assistant sanitary engineer, United States Public Health Service; M. R. Tillotson, formerly civil engineer of the park and now superintendent; and G. L. Davenport, assistant engineer, Santa Fe Railroad Co. The plant was built jointly by the Government and the Santa Fe Railroad Co. Mr. J. R. Eakin, formerly superintendent of the park, had general supervision over the part built by the Government, with Mr. Tillotson in active charge of construction, and the work done by the Santa Fe was under the general supervision of R. B. Ball, chief engineer coast lines, and G. L. Davenport, assistant engineer.

The plant was operated for one month at the start by Frank R. Shaw, associate sanitary engineer, United States Public Health Service, and he was succeded by Dario Travaini, who is now in charge and who supplied the chemical and bacteriological analyses given in the tables.

Acknowledgment.—The above article is taken from the Oct. 5 issue of Public Health Report.

Beccari Garbage Disposal System for Florida City.—The city of Dunedin, Fla., has contracted for the installation of a garbage disposal system of the Beccari type.

Toledo's Airport. — The Municipal airport of Toledo, O., has an area of 225 acres. The transcontinental airport located south of the city has an area of 560 acres.

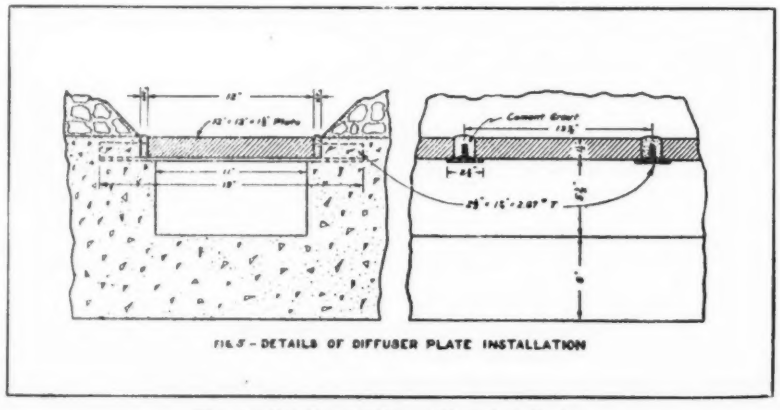


Fig. 5.—Details of Diffuser Plate Installation

[1]Estimates, but believed correct within 2 ct. per 1,000 gal.

The American Engineering Councils' Report on Traffic Signals

Interesting Comments on the Recently Issued Report

By GUY KELCEY

Manager, Traffic Engineering Division, American Gas Accumulator Co., Elizabeth, N. J.

IN the invitation which was extended to me to speak at this meeting, it was requested that I offer appropriate comments on the American Engineering Council's Report on Traffic Signals.

I find myself in the very difficult position of discussing this report before it has been presented and without having had an opportunity to ascertain clearly just what changes have been made in the tentative draft upon which my discussion is based. I shall, therefore, proceed on the assumption that the tentative report has been adopted in the final draft, except for such modifications as have been called to my attention during the past few days.

Good Work of Committee.—The committee has organized and clarified much that has been confusing to traffic officials. Within the range of present traffic experience and knowledge, this committee has done most excellent work and their effort will be of great value to the traffic official and to the manufacturers of traffic devices, who, by the way, are distracted by the great variety of demands for special equipment which does not fit in a quantity production program.

The time for this discussion is limited, so, while much should be said in praise of the conclusions of the report, it would seem more constructive to confine my remarks to those aspects of the report which may possibly be confusing to traffic officials or which may later be subject to modification.

The United States has gone in for standardization to a greater extent than other nations. Our urge to standardize arises principally out of several motives. There is the standardization of intolerance and of the fixed idea. There is the standardization of habit, to which we all conform to avoid being unconventional. Again, standardization of production which permits the manufacture of many identical articles with the advantage of low cost, ease and economy of repair, maintenance and replacement. Finally, there is the uniformity expressed by the standardization of road signs which, like the alphabet, enables us all to read the same message at a glance, just as we all read the same language.

Opportunities of Standardization for Good or Evil.—Before proceeding to the details of the report, it is proper at this point to mention that standardization has opportunities for both good and evil. If standardization is overdone, or if it be premature, it can easily close the door on improvement and on invention. Again, it is not easy to standardize without taking into consideration all conditions, because the scope of any one man's experience in traffic work cannot comprehend all conditions. This may be illustrated by the many attempts at standardization of traffic practice during the past eight years. A highway official with mountains to contend with has an entirely different idea of a curve, turn or grade than a highway official in a prairie state. The narrow, winding streets of New England towns present an entirely different problem than the wide, straight streets of some western cities. No one who has not had to take the responsibility for the solution of multiple intersection problems, such as are to be found in the six point intersections of Indianapolis and Chicago, can have a very sound judgment of what may or may not be used in their treatment. The driving habits and abilities of motorists in South Carolina, Wisconsin and New Jersey are surprisingly different. So condition after condition varies from one jurisdiction to the next, and so, likewise, does the point of view of what is the proper treatment and the proper standard. As a result, we have had a great number of standardizing bodies or groups in different parts of the country, whose conclusions are sound within the range of their limited experience. We have also had a tremendous pressure to standardize on pet ideas from a considerable group of persons who make traffic an avocation and not a business and whose real experience is in question.

It seems proper to say, therefore, that standardization will be attained in actual practice only when the combined experience of men with a great variety of local traffic problems is added to the experience and ability of highway officials who drive thousands of miles a year over every conceivable kind of road, whether it be the shell roads of Louisiana, the gravel roads in Wisconsin, the mud roads of other states; the long, high speed stretches of concrete, or narrow, winding, mountainous highways of our eastern and western states. Until these conditions are reconciled, national standardization is not possible because any standard adopted, which does not fit, will not be used in practice.

The American Engineering Council, in its present effort, has probably gone as far as it is possible at present to combine in the personnel of its committee as wide an experience as possible, but their effort will have permanent value only insofar as the investigations and study of this committee are expanded and continued and the standards code, which is here presented, modified and improved in terms of changing conditions and experience.

Standard Highway Signs.—For a number of years the American Association of State Highway Officials and the Bureau of Public Roads have combined their best experience to formulate and produce a set of standard signs. This standard suits the highway problem; whether in mountainous or flat country, or on mud or concrete roads. The American Engineering Council Committee, in its report, recognizes and adopts this standard with some modification. Under the standard referred to, a sign 24 in. on a side, and used as a square or diamond, constitutes the backbone of the system of signs. Used as a square, the horizontal dimension is 24 in., and as a diamond the horizontal dimension becomes 34 in. There are many towns and cities where the streets are so narrow and where there is so little sidewalk space that, if this diamond sign is installed, it will absorb much and, in some cases, all of the usable sidewalk width. In addition, the points of this sign are dangerous to pedestrians, and particularly to running children. This standard is perfectly adapted to highway practice but, unless the same type of sign can be used in cities and towns, the system can hardly become a national standard. In this instance, highway officials, thinking only of highway problems, adopted a most excellent standard for their use. Many municipalities cannot use it effectively, and it cannot, therefore, become a universal standard without modification. This modification the Committee of the American Engineering Council has seen fit to make, by reducing the dimension to 18 in. instead of 24 in. This modification is still probably not enough. It should be required that the points of the sign used as a diamond be rounded off to safeguard pedestrians and children. Since town signs must present as little horizontal width as possible, it is desirable that the diamond shaped sign, which presents a maximum horizontal dimen-

sion, be used as little as possible or not at all, and, if the shape standard could be changed, it is highly desirable that the diamond sign be eliminated where narrow streets are involved. The problem could be met by installing all such signs at an elevation of 8 ft.

Street Traffic Signs.—Under Section 1 on "Street Traffic Signs" appears a list of eight traffic requirements, which are designated by various shapes and dimensions. All these requirements reduce to three—prohibition, limitation or information. A diamond shaped sign, which indicates a condition inherent in the roadway itself, is specified for "Slow," and a square sign, which warns of a condition not inherent in the road, is to be used for "Caution." One wonders if the average traffic official will know where to use a "Slow" sign and where to use a "Caution" sign, and if, after he has made his decision, the public will know the difference. For practical purposes, are not "Slow" and "Caution" the same thing to the average driver? If so, a driver will react the same to either one, and why should one be designated by a diamond and the other by a square sign? This illustration is used to suggest that distinctions can be too finely drawn for the average driver's comprehension and that efforts at standardization should aim to simplify. It is hoped that your committee has in mind the ultimate simplification of the various designations, which, in the end, can express no more than "Stop" or prohibition, "Caution" or limitation, and finally, information.

The committee's report urges the adoption of a stop sign with a red lettering "Stop," and points to the advantage of being able to eliminate the red lettering. It is urged that the committee reconsider this action, since much, if not most, of the stop sign work of the future will be done with reflecting material, which, under the influence of atuomobile headlights, will cause the word "Stop" on the sign to stand out brilliantly to the driver at night. To produce a color with light, it is necessary to screen out or take away part of the light, and that which is left is the color required. To produce red, 60 per cent of the light is lost and 40 per cent is used. Under actual road test, one make of reflector stop sign with red letters was just readable at night under driving conditions at 121 ft. and with white reflecting letters of the same material at 215 ft. To produce, therefore, red lettering, it is necessary to sacrifice so much visibility at night that the standard which requires the luminous part red is of questionable benefit. The committee's decision to use a yellow background and a red lettering for a stop sign would appear to be sound since, in the proper interpretation of colors, red indicates "Stop" and yellow "Caution." It is suggested for the committee's consideration that so much is to be gained by having luminous or illuminated lettering on a stop sign white; that this should be permitted, and that the reflector lettering "Stop" be bordered with red, thus satisfying the requirement that red be used.

Height and Location of Movable Posts.—Attention is called to requirement No. 2, entitled, "Height and Location of Movable Posts on Roadway," in which it is suggested that the center of the sign be 4 ft. above the pavement. Immediately following this recommendation, it is suggested that if reflecting signs are used, they shall be 3 ft. above the pavement. This would appear to be reversed, since an ordinary non-luminous sign must be down in the range of headlights to be seen, and, therefore, centered at 3 ft. above the pavement, while a reflecting sign collects enough stray light anywhere up to 8 ft. above the pavement to render the reflecting units brilliantly luminous under the headlights. A non-luminous sign should never be placed above the headlight range; while a reflecting sign is effective even though above the headlight range, and, therefore, may be so placed.

Comments on Stop Signs.—The section of the report on stop signs invites several further comments.

In Paragraph 4, under Rule 10, it is indicated that "A stop sign shall be placed at a point where the message is to be obeyed. At intersecting streets, this point is on the property line of the side protected street." This recommendation is open to some queston. The property line in some instances is so far back from the curb line of the through street that vision is obscured by foliage, street light, telegraph and other poles. From such position, traffic on the through street cannot readily be seen. If this rule should be adopted the careful driver would stop at the property line, where the law requires, and would stop again near the curb line, where he can see the traffic he has to cross. Under this rule, if he is not a careful driver, he will cause accidents. It is suggested for consideration, that this rule be revised, and that traffic be required to stop where the best visibility of the intersected street can be obtained, and that a stop line be painted on the pavement at this point.

The committee is to be commended upon its adoption of the sign wording "Stop, Through Traffic." There are approximately sixteen different variations of the wording "Through Traffic Stop," such as "Boulevard Stop," "Through Highway Stop," and more recently Massachusetts' proposal of "Through Way Stop." After all, whether it is a way, a highway, a boulevard, or an avenue, the reason for stopping is "Through Traffic." The expression "Stop Through Traffic" fits every case, and combines the sixteen variations into one which is universal.

Under Rule 16—"Slow Signs," it is recommended that the word "Slow" be in 2-in. letters when used with "Hill" and other similar designations. A 2-in. letter, to a person with normal eye sight, is readable at 125 ft. in daylight; and at 10 ft. under headlights at night. Restated in terms of time, this means four seconds at 20 miles per hour during daylight. At night it is of no value. It is a question if the word "Slow" has any value on a sign if it is put in 2-in. letters. The question also arises if the words "Hill," "Cross Street," etc., need to be supplemented by an insignificant word "Slow" when it helps to confuse the main message and when the main message tells the whole story.

Stop and Go Signals.—Under "Street Traffic Control Signals"—Section 2, it is suggested that stop and go signals should not be operated at times when the volume of traffic is reduced. A stop and go signal is usually placed at a difficult corner. As the volume of traffic decreases, the speed increases. Many traffic officials have found it expedient and of great benefit when the normal operation of the signal is discontiuued, to operate the amber as a flashing light. This is suggested for consideration by the committee.

The use of two or three colors for stop and go signals is a question of controversy, a limited number of cities and towns having adopted the two-color. The great predominance of opinion seems to favor the three-color. Under the circumstances, the advisability of mentioning the two-color at all in a standard of this kind is doubtful. If, in the investigations made by the committee, the subject is so obviously in doubt and not definitely clear, all reference in the standard to the use of either two or three colors might well be left out, for the reason that the publication of it in the standard will cause much confusion. In my own experience, the use of amber after green is not only finding increasing favor, but perfectly fits the traffic need. On the contrary, the use of the two-color signal or the amber after both green and red leaves much to be desired.

Signal Specifications.—Under "Signal Specifications"—Rule 60, Item 2, a 60-watt capacity lamp has been specified as standard. Sixty-watt lamps in some signals which have been installed give an indication that is so poor that the signal is a hazard rather than a safeguard. In other signals, the indication is good. Any standard set up around the matter of lamps or optics used in a signal should be in terms of the intensity and distribution of the signal indication. As a matter of fact, it is the signal indication to the driver with which we are actually concerned. Properly used, a 25-watt lamp can be made to give a far better indication to the driver than a 60 or 100-watt lamp improperly used. This leads to the

point that a highly desirable standard which should be adopted as early as possible, should concern itself not with the kind or size of lamp, but should establish a minimum requirement for light distribution and intensity of signal indication to the driver and to the pedestrian.

It is very gratifying to know that the committee has seen fit to re-comment against words on signal lenses. One is always reminded of the milk wagon horse in Stamford that shied at a cat one morning at 4:30 and ran away. Two blocks down the street he came to a stop and go signal that switched from green to red, and the horse stopped. They vouch for this story in Stamford, and, if it is true, it indicates that horses know what red, yellow and green mean, and humans ought to. This has been a troublesome point for years.

The committee expresses the thought that only one type of signal installation should be used in each city. I should like to register my opinion that, to attain such standardization, sacrifices efficiency of treatment for many locations. If the signal is a good signal and properly designed, it will find traffic and compel attention and drivers will not have to hunt for it. In my opinion, a good signal may be placed in a variety of positions on a corner to advantage. It is suggested that the requirements for standardization of location should be that the signal or signals shall be visible to the traffic approaching from any direction.

Height of Signal.—Under the "Height of Signal," the Report states that experience indicates that the bottom of the housing should be 4 ft. to 8 ft. above the pavement if the signal is inside the curb line. This conclusion is open to question, because at any height under 8 ft. the signal is likely to be obscured by parked, stopped or moving vehicles.

The report leaves one with the strong impression that obstructions, such as various types of signals and mushroom buttons in the street, are not considered with favor. I offer as my own opinion that one of the greatest difficulties with traffic arises out of irregular movements of vehicles at intersections. These irregular movements can be prevented without interfering with the proper operation of vehicles, expediting the movement of traffic and reducing accidents. Safety zones and refuges in the throats of streets are in many cases very valuable for such work.

Railroad Crossing Gates.—Rule 79—"Railroad Crossing Gates." There is a considerable problem here since railroad crossing gates are usually lighted by a small red light or lantern that appears to be so much like a tail light that drivers pass around it to the left. For this reason, most gates are broken to the left of the light. Some standard night marking and illumination should be provided for railroad crossing gates which will eliminate this difficulty.

On the subject of railroads, there are many railroad, track circuit operated, train approach signals in the roadway on streets and highways, that give an indication only when a train is approaching and constitute a real menace to vehicles at night. It is urged that a standard be adopted requiring that all such signals located in the used portion of the roadway should be equipped with a flashing amber light to operate at all times when the train approaching signal is not being given.

We hear a great deal from railroad men about vehicles running into the side of trains. Those of us who drive 20,000 to 30,000 miles a year are well aware of this situation. Again and again one pulls up just in time to avoid running into a freight train standing or moving across the road, which so blends into the background landscape, that it is not visible to the driver, and this is particularly true on rainy nights. Something should be required to render freight cars, particularly on long trains, visible at night.

In the Report, the expression "wide" as distinguished from "narrow" streets is used in a number of places without exact definition. A street which would be considered wide and suitably straight in Marblehead, Mass., would be called narrow and winding in Atlanta, and a wide street in Atlanta would be called narrow by the City Engineer of Minneapolis. Narrow and wide streets should, therefore, be exactly defined.

Safety Zones.—In Rule 84, under the subject "Protection of Safety Zones," several suggestions are offered for the consideration of the Committee. The traffic approach ends of safety zones should be parabolic in shape. When this shape is used, a vehicle striking the zone is deflected. When any other shape is used the vehicle is stopped abruptly.

In connection with safety zones, the report suggests that posts be used to safeguard the zone. This, in my judgment, is a dangerous practice, because a vehicle colliding with such a safety zone will usually strike a post with the left side of the machine, and the force of the movement of the vehicle will swing it into the safety area, and not deflect it away from the zone. Again a red signal is recommended for the traffic approach end of the safety zone. One wonders if this is not a misprint, since, under all standardization actions of recent years, including that of the present report, red is recommended only where a stop is required. The use of a red signal on a safety zone would be, in my judgment, a most serious error.

Who Has Right of Way.—While the subject has never been brought up for serious discussion, I wish to question one of our most fundamental traffic rules, namely, the requirement that "The man on the right has the right of way." This matter first came to my attention in an article written by E. B. Lefferts, now of the Automobile Club of Southern California, and justifies serious consideration. The history of this regulation seems to be that in Europe, where traffic drives to the left and not to the right, the regulation was and still remains that the man on the right has the right of way. We changed this rule from driving to the left to driving to the right, but we did not change the regulation that the man on the right has the right of way. Actually, when traffic drives to the right, the man on the left should have the right of way, and most drivers agree that, in their own experience, they give right of way to the driver on the left naturally, and that to give right of way to the driver on the right is unnatural. Under the regulation of "The man on the right has the right of way," a driver approaching an intersection must keep his eye on the man who is approaching from his left, because he is the man most apt to hit him. At the same time, he must look away over to his right, to see if he must give right of way to someone approaching from that direction. A driver must, therefore, look in two exactly opposite directions at one time, and it cannot be done. If, in the exact meaning of the regulation, a driver gives right of way to a driver on his right, he stops in the intersection to do it, a position which is not only dangerous but which blocks other traffic. We may never change this rule, but after thinking about it and observing its operation for some years, I have come to the conclusion that it ought to be changed and urge the Committee to consider the matter.

My endeavor in these comments has been to present constructive criticism of the report. They are presented with the utmost respect for the difficult work the committee has had to do and for the most excellent job they have made of it. No one who has not sat on such a committee knows the difficulties of formulating exact standards from a mass of complicated opinions, practice and ideas, nor the difficulty of reconciling the opinions of the members of the committee.

The American Engineering Council's Report is as a whole most excellently done. It is a foundation on which our future traffic standards are now stated or upon which they will be built. Contrary opinions which have been expressed relate to points which, in my judgment, must ultimately be modified, if the standard is to be fully accepted and adopted by the traffic officials, who, after all, take the responsibility for the expenditure of public funds and whose reputations depend on the results obtained. The judges in this case are the drivers, few of whom can say what is right, but who are quick to know and to say so when a traffic treatment is wrong.

In conclusion, it is important to point out that these or any other standards are subject to modification in order that they may fit new conditions or as new experience may require. In their use, there will be many questions as to the meaning and interpretation of the provisions of the standard. For these reasons, the committee's work has only just begun. It is of the utmost importance that the American Engineering Council or the Hoover Conference arrange to have a committee of, say, three men who are actively engaged in traffic work and who can be referred to, to interpret the provisions, settle questions which are certain to arise, and who will keep abreast with developments so that provisions of the standard may be promptly modified when necessary. If this is not done, this will be just one more set of standards, accepted by some and misused or ignored by others.

Acknowledgment.—The above paper was presented by Mr. Kelsey before Public Safety Section of the National Safety Council at the 17th Annual Safety Congress held Oct. 1-5 in New York City.

Bridges Over Navigable Waterways

Some interesting facts regarding bridges over the navigable waters of the United States have been compiled by the National Rivers and Harbors Congress from the detailed reports made by the chief of engineers.

The total number of bridges of all kinds, in 1927, was 6,643. Of these 2,337 were steam or electric railway bridges, practically all the others being for highways, although there are a number which carry both railways and highways.

There are 3,994 fixed and 28 suspension bridges, 1,771 with swing spans, 61 with vertical lifts, 34 with pontoons, 19 with retractile and 12 with removable spans, 20 with other varieties of openings, and 37, the structure of which is not designated.

The most unusual bridge in the country is the aerial ferry across the ship canal at Duluth, Minn. A platform at street level is suspended from the bridge proper, which is 135 ft. above the water, and this platform carrying automobiles and pedestrians is moved back and forth across the canal by electric motors. This unique structure is soon to be replaced by a vertical lift bridge.

There are 39 bridges which have 200 spans or more. One at Corpus Christi, Tex., has 1,150 and one at San Mateo, Calif., has 1,278, but the prize goes to the Norfolk & Southern Ry. bridge over Albemarle Sound, at Edenton, N. C., which has no less than 2,093 spans.

There are 62 bridges which are 100 ft. or more above the water, the highest, 230 ft., being the lower steel arch at Niagara Falls. There are two other high bridges at Niagara Falls, one 214 and the other 192 ft. The third in height is the one across the Snake River at Riparia, Wash., which is 210 ft. The bridges across the East River, New York City, have a clearance of 135 ft.

The longest single span in the country is the suspension bridge between Philadelphia and Camden, which is 1,686 ft. The Detroit River bridge, which will be finished in 1929, will have a clear span of 1,850 ft., while the bridge across the Hudson at New York City, which is to be done in 1931 or 1932, will be nearly twice as long, or 3,500 ft. It is said that plans are being drawn for a bridge across the Narrows of New York Bay with a span of 4,500 ft.

Highway Traffic Association to Meet at New Orleans

The South Central Division of the National Highway Traffic Association will hold its annual meeting Dec. 3 at Roosevelt Hotel, New Orleans, La. The meeting will be held on the registration day of the 7th Annual Asphalt Paving Conference, which will be held at the same hotel. All persons interested in the advancement of the efficiency of highway transport and traffic control are cordially invited to attend the meeting and take part in the discussion of the addresses to be presented. The program of the meeting follows:

Presiding officer: Col. R. Keith Compton, honorary vice-president National Highway Traffic Association, president American Road Builders' Association, and director of public works, Richmond, Va.

"The Traffic Control Program of New Orleans," by Bryson Vallas, city engineer, New Orleans.

"The High Cost of Highway Transport of Bottlenecks," by George E. Hamlin, chief engineer of maintenance, Connecticut State Highway Commission.

"Highway Traffic Control of Montreal," by J. E. Blanchard, chief engineer of the Road Department of Montreal.

"The Traffic Control Problem from the Viewpoint of the Man of the Street," by Harold B. Pullar, secretary, James B. Berry's Sons Company, Chicago.

"One Hundred Cents for the American Highway Dollar," by Arthur H. Blanchard, consulting engineer, National Highways Association, and Highway Transport and Traffic Control Consultant.

Newark's Municipal Airport.—The first unit of the $6,000,000 municipal airport of Newark, N. J., was completed on Aug. 1.

City Held Responsible for Typhoid Cases

A decision of much interest w handed down Aug. 30, 1928, by the Cal fornia Supreme Court. The decisio was in the case of Rutterbusch et al. City of Pittsburg, Calif., and 18 othe cases (269 P. 930), and is cited as fo lows in the Oct. 19 issue of Publi Health Reports:

"Actions were brought against th city of Pittsburg to recover damage for the death of a person from typhoi fever and for the illnesses of other persons who were affected with typhoi fever and dysentery. It was alleged that the diseases were caused by the negligence of the city in permitting its water supply, furnished to the inhabitants of the city, to become polluted. The water supplied by the city required purification before being safe for human consumption, and to meet this need the city operated a chlorination plant. Evidence showed, however, that upon a certain night in the early part of June, 1920, the chlorination plant was inoperative for about 12 hours, and that during said period unchlorinated water was let into the mains. There was also evidence which strongly tended to show that an epidemic of typhoid fever and dysentery broke forth in the city within about three weeks following the admission of the unchlorinated water into the mains. Other evidence was also introduced tending to show that the period during which the diseases occurred corresponded to the time within which epidemics of typhoid and dysentery follow upon the use of germ infected water. Judgments were entered by the trial court in favor of the plaintiffs, and such judgments, on appeal by the city, were affirmed by the supreme court, which, in the course of its opinion, said:

"On behalf of the defendant it was sought to be shown that some effort was made by its agents and officials during the brief period when its chlorination process was not in use to purify said water by other means, such as the introduction of lime into its content; but this evidence was unsatisfactory through the failure to show that the substituted method either would or did have the effect of purifying said water.

"Considering the evidence in each of these cases as a whole, the deduction seems to be inescapable that the epidemic of typhoid fever and dysentery which broke forth in the city of Pittsburg within the aforesaid period after its agents and officials in charge of its water system had permitted unchlorinated water to be served through its water mains to its inhabitants was directly traceable to that cause, and that the cases of death or illness which form the basis of these actions were the direct result of the negligence of the agents and officials of said municipality in the foregoing regard.

"The argument put forward by the appellant to the effect that the epidemic in question might have had its origin in other sources, such as the use of water from wells in various parts of the city, creates at best but a conflict in the evidence as to the source of infection, and this evidence is weakened as to its inferences by the fact that, while these other sources of water supply had existed for a considerable period of time prior to the month of June, 1920, no epidemic had resulted until the particular period following the pollution of the municipal water supply.

* * *

"Treated by and large, we are of the opinion that the judgment rendered and entered by the trial court in each of the foregoing cases is sufficiently supported by the findings of fact and conclusions of law applicable to each of said cases, and that as to each, the evidence was amply sufficient to justify the findings of fact and conclusions of law of the trial court."

Adaptability of Asphalt Pavements

Universal Use of Mixtures for Resurfacing and Temporary Surfacing Discussed

By WALTER H. FLOOD
Walter H. Flood & Co., Chemical Engineers, Chicago, Ill.

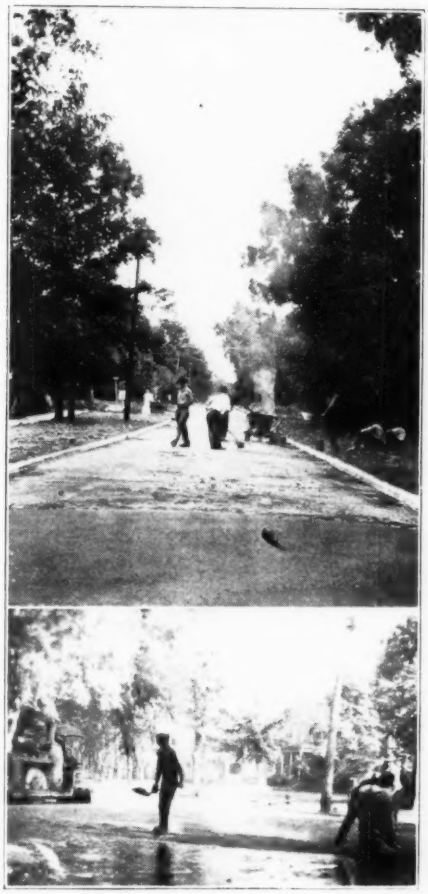
ONE of the distinct advantages of the asphaltic type of pavement and one which is frequently overlooked by engineers and city officials is the ease with which it can be adapted to the restoration of old pavements and road surfaces which from various causes have been rendered unfit for present day traffic.

It is common practice to cover old brick pavements with an asphalt surface, although even here, too, often the entire pavement is rebuilt at an unnecessarily high cost to the taxpayer. However, there is more hesitancy exhibited in dealing with the problem of other types of construction such as macadam streets and gravel roads, either plain or tar treated, disintegrated concrete or asphalt pavements which have worn out either through years of service or faulty design.

Any pavement surface of whatever type, if it is to be at all lasting, must of necessity be supported on a firm foundation, although, contrary to widespread belief, this is somewhat less true of an asphalt pavement than of the rigid types. There are numerous examples of asphalt surfaces on black base where the subgrade is slightly yielding, which although they have become uneven in contour are unbroken and are giving good service. Under the same conditions a rigid pavement fractures from lack of subgrade support and rapidly breaks up and disintegrates. It is not advocated that less attention be paid to the foundation conditions of an asphalt pavement than for other types, but a point to be noted is that frequently it is necessary to construct a pavement on a new fill or other character of soil which could only be made perfectly firm at a cost which would be prohibitive or unwarranted, considering the amount of traffic to be carried. Under these conditions, unless the movement of the subgrade is excessive, an asphaltic type of construction lends itself admirably as being the most economical and serviceable.

In resurfacing an existing road or pavement with asphalt it is not only important that the foundation be firm and well drained, but it is equally essential to provide some means by which the asphalt wearing course will bond to the surface of the old pavement in order to overcome any tendency of the asphalt to displace. This is a detail which is frequently neglected not only in resurfacing but also in new work on a concrete base where a smooth surface of the concrete is insisted upon in the erroneous belief that a smooth surface on the base will produce a smooth wearing surface. Disastrous results usually follow such practice, for not only is it difficult and frequently impossible to obtain a smooth initial surface due to the shoving of the mixture under the roller, but there is grave danger of serious displacement after the street is thrown open to traffic. This displacement is one of the defects of an asphalt pavement commonly attributed to the asphalt itself, whereas, it is in many cases due entirely to a lack of provision for a means of bonding between the wearing surface and the base on which it is placed. If the surface of the base is rough, or other means are provided to secure a bond to prevent longitudinal movement of the asphalt, the tendency to displacement will be greatly minimized, and the only movement which can then take place will be due to an improper surface mixture. This fact is recognized in the use of various mechanical devices for producing a rough surface on concrete foundations. Distinction must be made between a rough surface and an uneven one. If the base prepared to receive the wearing course is uneven in contour, there is a great possibility of this unevenness appearing on the surface of the finished pavement, and in fact, this is one of the principal causes of irregular surfaces of asphalt pavements. It is therefore important that whatever method is employed in obtaining a rough surface, the general contour of the street should be maintained and any tendency to produce depressions should be avoided. Should there be deep depressions as usually occur in old pavements to be resurfaced, they should be filled with binder mixture so as to make a fairly even contour, or in the case of gravel and macadam roads they may be shaped up and the depressions filled with stone or gravel thoroughly rolled in place. Care must be taken in the preparation of old macadam pavements that there is not an excessive amount of fine material present, thus making the surface too tight and smooth and preventing a proper bond for the asphalt. The surface of such roads should be broomed, water being used if necessary, to remove all dirt and fine material and leave the surface in a uniformly rough condition. Very often a scarifier is used to an excessive degree in shaping up a road for surfacing, with the result that the solidity of the base is greatly impaired, increasing the tendency to settlement and other movement. The existing roadbed should be disturbed as little as possible in order that it may be firm and unyielding before placing the asphalt mixture. Where the subgrade holds water, proper drainage should be provided.

The resurfacing of concrete pavements requires a somewhat different treatment, as they have little or no crown, and usually the greater area of the surface is too smooth to afford a bond with the asphalt. The concrete may be roughened with picks or pneumatic chisels, but a more satisfactory method for holding the wearing surface is to apply a paint coat of asphalt cement, cut back with naphtha, over the entire surface of the concrete. The pavement should be thoroughly broomed and washed with water so that all dirt and fine particles are removed before the application of the cut-back in order



Resurfacing Old Concrete Pavement with Two-Inch Asphaltic Concrete

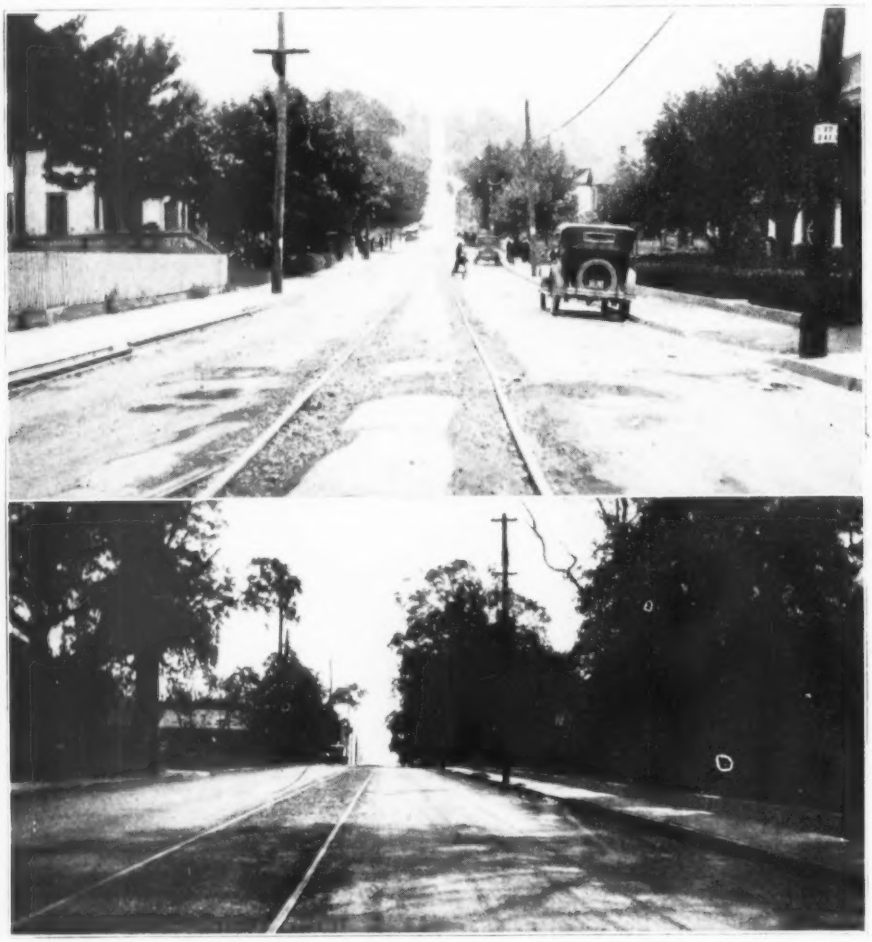
Applying Asphaltic Concrete as Resurfacing to Rough Concrete Pavement. Note Cut-Back Paint Coat Applied to Old Concrete, Quincy, Ill.

to insure its thorough adhesion to the concrete. The paint coat should be applied as thin as possible, as an excess will tend to soften the asphalt surface mixture. Rubber squeegees can be used to apply the paint, but if the surface of the concrete shows many irregularities and depressions, as is usually the case, better results can be obtained with brooms. Before the cut-back is applied, all loose concrete should be removed and the holes filled with black base or concrete. Sufficient black base or binder mixture should be used to give the street a good crown and it may be necessary to lay the asphalt with a depth three or four inches greater in the center than along the curb line. When there is gutter slab on the street to be resurfaced, this can be covered the same as the rest of the pavement and the asphalt surface mixture brought to the curb. It is not necessary to lay the asphalt to the full thickness along the gutter, and in this way considerable material can be saved, with consequent reduction in cost. For sheet asphalt the wearing surface can be bid on a square yard basis with all binder by the ton, and for a one course pavement the entire mixture can be bid on a tonnage basis, leaving to the discretion of the inspector the amount of material necessary to secure the most satisfactory results. This method will be found most economical, as it avoids the necessity of using the minimum specified thickness over the high areas of the existing pavement, which are usually very small compared to the entire surface.

Binder Course Being Laid Over Old Brick at Danville, Ill.

In resurfacing old worn out asphalt pavements, a similar procedure is followed. If the pavement surface still contains considerable asphalt, it is not necessary to apply a paint coat, as the fresh hot surface mixture will bond to the old provided that the latter has been thoroughly cleaned. However, as most asphalt pavements which require resurfacing are more or less deficient in bitumen, it is better practice either to apply a paint coat or to soften the existing surface with a heater. When the surface of the asphalt is fairly continuous, as is the usual condition, a one-inch resurfacing will ordinarily be found sufficient, using binder to fill the depressions and to replace disintegrated areas.

There can be no question that with good workmanship, a properly designed mixture and careful attention paid to secure a firm, well drained foundation, suitably prepared to hold the wearing surface, a satisfactory and lasting pavement will be assured. It is the neglect of one or more of these factors which causes failure. No other type of pavement adapts itself so readily and universally to the various conditions met with in practice as does asphalt.



Old Penetration Asphalt Street Before Resurfacing with Two-Inch Asphaltic Concrete, Bluefield, W. Va.

Two-Inch Asphaltic Concrete Resurfacing Over Old Penetration Asphalt Macadam Pavement. Pavement Along Rails Surface Treated Only. Photograph Taken Four Years After Construction

Meterage Financial Advantage to Consumers

In their fourth annual report for the year ending June 30, 1928, the Trustees of the Bath Water District, Bath, Me., set forth as follows the advantage of meterage:

"As your trustees have repeatedly pointed out, by far the greatest expense of operation, amounting to substantially 75 per cent of total expenditures, is in the pumpage of water, including labor, fuel and power. Universal experience has demonstrated that the best, and indeed the only practical way to reduce that item of expense, is to require all services to be metered. Under existing local conditions, we have hesitated to require, at present, a general metering by all consumers. The increase in metered services during the last two years has not been encouraging, the number added being only thirty, making the present total of all metered services 789. We cannot too strongly impress upon consumers, particularly domestic users of water, that the installation of meters is for their own financial advantage. The initial cost of installing a domestic meter, which remains the property of the consumer, is small, and the saving in water rates is considerable."

Planning Principles for Smaller Cities

Suggestions for Carrying Out City Planning Programs

By JACOB L. CRANE
Planning Consultant, Chicago, Ill.

FIRST of all a good city plan should reflect the sound ideals and ambitions of the city for which it is prepared, and not only the preconceived theories of city planning as pronounced by the planning expert. It strikes me that a good deal of city planning publicity work and what is termed public education is unconsciously aimed at cudgeling the public into an acceptance of the city planner's theories of what the city should become and of the means to attain that end. The converse of this point of view is in reality more nearly sound.

The Publicity Campaign.—The "publicity" campaign should be aimed to arouse the citizenship to a free consideration of the city's destinies and problems and the city planner should properly be sensitive and responsive to the townspeoples' own ambitions and ideals and not solely to his own.

There are, of course, two arguments against this suggested point of view; first, the danger that what I have called the townspeoples' ambitions will resolve themselves into the purely material ambitions of individual property owners and business interests, and second, that the characteristic joint ambition of the American town does not permit of the application of the ideal type of city planning theory. In answer to the first of these arguments I would say that if the citizens are given a good opportunity during the preliminary discussions to formulate their ideas of the town's development there will be no lack of consideration for the city's welfare as a whole, and that the unsocial objectives of individuals can be readily sorted out. To the second argument I would ask, who can say precisely what the soundest city planning theory for a town may be unless it is the ideals of the community itself?

An Important Basic New Idea.—An illustration of an important basic new idea just now emerging from obscurity in the public consciousness is the tendency to face residences away from the street, placing the service entrance toward the road, reducing the size of the front yard, and facing the living quarters to the "rear" where private play space and gardens may be developed. This idea may vitally affect the future city planning of our towns, and in my opinion the tendency is a good one. The point here is that too arbitrary zoning, building and platting regulations, although conceived in good faith, might serve as an obstacle to this logical and desirable tendency.

The American city is unlike any of the city types for which the earlier city planning theories were developed, and furthermore, its destiny as a physical organism is still obscure except insofar as we can appraise the significance of the underlying factors and tendencies and popular ideals which emerge year by year. It is my feeling that while more time and trouble and sensitiveness on the part of the city planner are required to put this principle into effect, it nevertheless remains a principle that the American city will achieve its destined sound and characteristic development only if the city planner and the city plan reflect as fully as possible both the expressed and half-unconscious ambitions of the people themselves. Obviously this principle applies with greater applicability to the smaller city where it is more nearly possible to get at the public sentiment than in the heterogeneous larger cities already prematurely crystallized in their physical form.

What the City Plan Should Interpret.—The city plan, then, should interpret and formulate and devise means for putting into effect what we may call the popular image of what the city should become. The city planner must, of course, suggest directions which the popular idealism may take, but his real job is to establish practicable plans and procedures toward the realization of a sound popular ideal. In doing so, however, the second principle appears, namely, that the greatest advantage of city planning for the growing American town lies in what we may call the guidance factors, and not in the proposals for costly re-construction. By guidance factors I mean building codes, zoning ordinances, subdivision control, supplemental building lines, guidance in the acquisition of public lands at an advantageous time, and control to prevent undesirable conditions from growing worse particularly in such matters as the location and arrangement of buildings along streets which require re-construction for widening.

For two reasons this principle applies with special emphasis to the smaller city. Such cities are not financially capable of carrying out elaborate and re-construction plans. And since their major development is still ahead of them, the proportionate value of the guidance features is even greater than in the big cities. For the sake of the planning program itself there should be special emphasis upon those features of the plan which control new building and new development because through them critically important objectives can be attained at little or no cost to the community which in itself tends to stimulate public interest and support for the entire project. These guidance or control elements of the plan are frequently found to be more urgent than the elements calling for expensive clearing of land or reconstruction, because by virtue of them the otherwise inevitable danger of creating conditions which will later require rebuilding is largely avoided.

Effect of City Maturity on Planning.—From the planning point of view cities vary greatly in their degree of maturity, and this variation seems to be more or less independent of their actual age. I have found comparatively old towns quite immature in their planning outlook and quite incapable of utilizing more than the most elemental planning control. On the other hand I have found growing cities of considerable size as yet young in years, but mature in their civic outlook and capable of going far with city planning programs. Some of the factors controlling this situation are the character of the population, the nature and quality of the city government and even the type of public education. From this consideration the principle emerges that for each city the planning proposals made for adoption should be in scale with the city's capacity for applying them. This is true in determining the degree of elaborateness and complexity of the zoning ordinance, the subdivision control, the proposals for acquisition of public land, and perhaps most of all with the suggestions for projects which require the unusual expenditure of public funds on street widenings. Again this principle applies with particular force to the smaller cities where it is possible to appraise with fair accuracy the city's capacity for utilizing a city plan and where the necessity for moderation in the proposals is greater because of the smaller funds which will be available.

Premature Crystallization of City Planning Theory.—Finally, I would like to lodge a protest against what has seemed to me to be premature crystallization of city planning theory, particularly when put into effect through specific legal regulations. Every phase

of American city planning is and should be considered to be still in the process of formulation, and both the city planner and city governments should not only make it possible for plans and ordinances to be revised, but should actually encourage the instigation of new principles so long as these principles have to do with the sound logical development of the city as a whole. The imposition of planning regulations requiring road dedications of a certain width on all section lines and half section lines without a definite plan to guide the location of the roads, the acceptance of the theory that a certain type of building will always be characteristic and necessary, for example, tenement-like apartment houses, and reliance upon any one type of transit as permanent and exclusive of all others, are typical of the kind of thing which I have in mind. It has occurred to me that the rigid exclusion of all industry from residential districts may eventually militate against both a desirable type of industrial development and against the soundest physical growth of the city.

There are many examples of craftsmen type of industry which would suffer materially if required to locate in the dirtier industrial districts and which might appropriately be placed in residential districts with plenty of growth around them, with considerable advantage both to themselves and to the workmen and their families who have to go to and from these factories. In general, the problem of transportation for factory workers tends to increase as industrial districts are limited and residential districts grow farther and farther from the places of employment. These are only incidental illustrations of the principle that the whole city planning movement should be free to accept modifications in accepted theories as time goes on and new tendencies arise. For the smaller cities where there is still the opportunity to take advantage of new knowledge and new devices this principle is particularly valuable.

The four principles above stated are, I realize, subject to discussion. It is by such discussion, instead of by plodding along accepted channels, that the science and art of city planning will develop and more nearly fulfill its greatest usefulness.

Concrete Suggestions for City Planning Program.—To reduce this abstract discussion to concrete suggestions for carrying out a city planning program in a smaller city the following outline is given, with the qualification that it should be varied to meet individual local conditions:

First—Authorize by ordinance and organization a city planning and zoning commission—not a zoning commission only, nor separate commissions for zoning and city planning. The commission should be small in number, ordinarily not to exceed nine, and should have a personnel of the highest qualifications representing various interests. It is desirable that the mayor, at least one member of the city council, the city engineer, the city attorney, and a member of the park board be included.

Second—The commission should hold preliminary meetings to formulate the principal city planning problems; to determine the amount of necessary funds which should be appropriated for their work; and to draft an outline of advisory committees which may work with the central commission.

Third—Ask the city council for a definite appropriation for the first year's work with a statement of anticipated needs for succeeding years.

Fourth—Engage a planning consultant. Do not hire the "cheapest" man.

Fifth—Initiate a program for presenting to the public the development problems of the city and for securing as specific reactions as possible to these problems and to the general question of "What kind of a city shall we develop here?" Questionnaires and meetings with individuals and committees have been used to good effect.

Sixth—Get consultant's immediate advice on temporary control measures such as interim zoning ordinance and preliminary platting control, and submit recommendations to the city council on these measures.

Seventh—As each section of the plan develops and becomes ready for adoption secure as full public discussion as possible before presenting work to city for passage. Neighborhood meetings and meetings with civic clubs and individuals have been found valuable.

Eighth—Do not be satisfied with the mere presentation of report and plans, whether or not published. So far as possible present to the city council concrete recommendations, ordinances and plans which may be officially adopted, and follow them through to adoption.

Ninth.—Publish and distribute widely the reports and plans of the entire project.

Tenth.—Do not consider the plan commissioner's work finished when the plans are done, ordinances adopted, and report published. The commission should be a permanent institution with several specific duties such as examination of subdivision plans, and even more important duties in initiating modifications of the plans and ordinances and entirely new projects.

The above outline does not include a great many details which will follow as a matter of course if a consistent, consecutive program is carried out, such as the creation of boards of zoning appeals, and conferences with other public authorities such as school boards and park boards. In my experience city planning has been greatly delayed in many towns because no one seemed to have a definite idea of precisely what steps to take in getting the work started. After a definite program, such as the one outlined, is adopted, the earlier inertia rapidly disappears and the project goes forward by its own momentum.

Acknowledgment.—The foregoing is taken from a paper presented at the 20th National Conference of City Planning, Dallas, Tex.

Conference Approves Commercial Standard for Unions

Approval of a proposed commercial standard for malleable iron or steel screwed unions for use with standard weight pipe, was given Sept. 24, 1928, by a general conference of interested elements of the industry. This conference was held under the auspices of the Commercial Standards Unit of the Bureau of Standards, Department of Commerce.

This commercial standard pertains to black and galvanized types of brass seated malleable iron or steel unions.

Following the presentation of the proposed standard by Mr. R. E. Bryant of the Jefferson Union Co., Lockport, N. Y., Mr. I. J. Fairchild of the Bureau of Standards explained the operation of the certification plan that has been developed for industry.

The conference agreed that new production, in accordance with the schedule as defined by the standard, would begin on May 1, 1929, allowing until Nov. 1, 1929, for industry to use up existing stocks. The standard will be subject to annual review by a standing committee, in order that it may be kept abreast of such changes as may take place in the art. Members of this standing committee are: Robert E. Bryant of the Jefferson Union Co., Lockport, N. Y.; Myron H. S. Affleck of the Star Manufacturing Co., Providence, R. I.; Stanley G. Cady of the Rhode Island Fittings Co., Providence, R. I., representing the manufacturers;—The Stanley Sanitary Manufacturing Co., Fleck Brothers of Philadelphia, General Fire Extinguisher Co., Hajoca Corporation of Philadelphia, representing the distributors;—the Master Plumbers' Association, the Master Steamfitters' Association, American Gas Association, the Heating and Piping Contractors' National Association, representing the consumers.

Mr. Fairchild stated to the conferees that the Department would prepare the standard for submittal to industry for signed acceptance, at an early date. He also called attention to the fact that at least 65 per cent of the industry, by volume of annual production, must accept the standard in writing and with no outstanding opposition from the others, before it will be published by the Department of Commerce.

Conservation and Control of Ground Water

Recent Experiments in the State of Florida

By CHARLES CARROLL BROWN
Associate Editor, Municipal News and Water Works

THE West Indian tropical storm of September, 1928, was perhaps the greatest in history, in extent, if not in damage to property and life. After doing great wind and water damage in Porto Rico and in the West Palm Beach and Lake Okeechobee region of Florida, the storm turned to the north-east and did much damage mainly by heavy rainfall and flood in the states along the Atlantic seaboard from Northern Florida to New England. The floods were specially destructive in the states from Georgia to Virginia.

Across Florida run several rivers draining the southern portion of Georgia, which were swollen beyond the experience of a century, such as the Suwanee, Withlacoochie of Georgia, Ocklocknee, and others. Florida State Highway No. 1 crosses these rivers and was washed out in unexpected places and covered with water to an unexpected extent. One man has been found who thinks that he remembers a somewhat similar height of waters in 1848 or 1849, but otherwise there is no record or rememberance of the like since the first Spanish occupation of the state.

One series of washouts and floodings of the highway was due to the same storm but not to any of the rivers mentioned. These disturbances of roadbed are located near Live Oak, Fla., south and east of the Suwanee River but not drained by it. This portion of the territory is cut off from the river by a sandy ridge and has no outlet over the surface for its drainage. There are numerous lakes, ponds, swamps and low areas dividing the areas into many small watersheds, the water falling on which drains to these lakes or disappears in the sandy soil and ultimately reaches sink-holes apparently connecting with water passages in the limestone with which the state is underlaid at a greater or less depth. The central portion of the state from the north boundary south has numerous areas of the same sort, broken between the Suwanee River and Polk County by but one stream, the Santa Fe River, a tributary of the Suwanee.

Water Supply Sources.—This central portion of the northern half of Florida rises to a height of 200 ft. above sea level, more or less, in fairly well defined ridges apparently formed by a backbone of stratified limestone sloping east and west from an anticline. Practically all the municipal water supplies of the state are obtained from deep wells drilled until they reach "crevices" in the limestone sufficiently open and supplied with sufficient water to furnish the needed supply. How much of the water in these lower strata of limestone has its source in the sink-holes described is as yet unknown.

Unfortunately the cities in this portion of the state are not many of them located on the rivers and they are obliged to discharge their sewage, whether purified or not, into the sink-holes in their neighborhoods. The development of the country is adding to the pollution of the surface water draining into the sink-holes at the same time that the growth of the cities is adding to the pollution by sewage.

The larger cities of the state are located along the Atlantic and the Gulf coasts and are obtaining their water supplies from the same or similar substrata of limestone at greater or less depths by means of deep wells but at points nearer the common outlets of the strata, the depths of the Atlantic Ocean and the Gulf of Mexico. Some of them are close enough to such outlets to have drawn water, by pumping excessively during long periods of rainfall below the average, more rapidly than the depleted strata could furnish it, and consequently have drawn salt water into their supplies either from the sea or from other "crevices" connecting with the same or other sources of salt water. Such cities as Tampa, West Palm Beach, St. Augustine, St. Petersburg, and others have been obliged to seek other supplies and have built or are contemplating works to furnish treated surface water. Tampa has secured a satisfactory supply in this way, but not all cities are able to find such a nearby and adequate supply as that city.

Some of the largest springs in the world flow from outcrops of the underlying rock, or from near-outcrops and a few sink-holes operate in the reverse direction when the pressure of water in the "crevices" is high enough, owing to excess supply, to force the water out. Some of these springs are looked at with longing eyes as sources of future water supplies.

Conservation and protection of the underground and surface waters of the state has therefore become a very important problem. Recognition of its importance to the material interests of the state cannot be long delayed. Possibilities of pollution of present underground sources by future settlement of the state and methods of preventing such pollution if found possible are subjects demanding prompt attention and intensive study by experts.

What the Soil Maps Show.—In general the soil maps of counties show various fairly well-defined surface areas of sand of various kinds and sizes and mixtures of sizes and with various mixtures of clay, loam, silt, and organic matter, and of various clays. Ordinarily the surface is sandy but excavations, deeply cut stream channels, etc., show undisturbed clay beds underneath, ranging from gumbo and similar material rich in clay, to sandy clays or clayey sands. In these areas the rainfall, unless too heavy or long continued, is more or less gradually absorbed by the soil and finds its way slowly through the fine sand to outlets in springs and streams or directly into the underlying limestone. Excavations show seepage of this water through the sand and the characteristics of this flow of water and the relation of its presence in the subsoil to the amount of rainfall are quite well understood though not always studied so carefully as they should be in connection with the foundations of surface or underground structures. There is room for investigation on this line.

Studies will be simpler than in the North since there is not enough freezing of subsoil within the state to introduce that complication.

One of the washouts on Highway No. 1 illustrates many of the points above noted and may serve as an introductory illustration of the problems of detail to be met and the present methods of attacking them.

Cause of the Washout.—Many of the lakes, ponds and low spots in a sink-hole region are somewhere near the same elevation, even when the country is rolling. Since the seepage of water through the sand is slow, on account of the fineness of the sand, the ponds and low spots will fill up and water will overflow from one to another according to which one fills first. When an excessive rainfall occurs, such as the 10 in. in 24 hours, more or less, of the September storm, in areas of considerable size, several of these areas will be joined in these overflows and the run of the water will be from the ponds with on ordinary outlets to those with sink-hole connections. The washout in question seems to have been at a point where usually the amount of drainage water over the surface is slight and it was taken care of satisfactorily by the usual rather shallow ditch along the road, leading to a culvert under the

road at the low spot in the grade. This ditch was some 15 or 20 ft. above a lake with a sink-hole outlet, the ditch being on the southern side of the road and the lake some 100 ft. north of the road and at the foot of a gentle slope which was not washed by any water falling on the road or north of it. The culvert was an 18-in. vitrified clay pipe with head-walls and ample and safe passage down to the lake.

The road gang reports that the water from the ditch and apparently also through the ground found its way along the outside of the culvert pipe and began to run round the head wall and wash the bank. Usually it is easy to stop such leaks but in this case it could not be done readily and the bank was cut down until there was a wash-out across the road 15 ft. or more in depth. This depth of outlet for the ditch caused the cutting of a trench parallel to the road each way from the break, taking in a part of the pavement for 50 to 100 ft. in each direction and extending 200 or 300 ft. farther in each direction. Meantime the rolling fields had collected water in the low runways and ponds and swamps, which ultimately reached the ditch and cut it out still farther, especially to the east of the break, on account of the overflow from a pond to the south-east which, when filled by the rainfall had enough water and fall to cut the ditch along the road to a depth of 10 to 15 ft. and a width of 30 ft. or more, down to hard pan, which was about 5 to 10 ft. above the ordinary levels of the lake on the north side of the grade.

This cut laid bare about 15 ft. depth of bank on the south side of the cut and showed it to be sand with some mixture of clay and loam all the way down to the hard pan and of varying density. Its appearance coroborated to some extent the statement of the foreman that the seepage of water from the south bank after the washout had the appearance of coming out so rapidly in spots as to almost seem to be coming in streams. This is an exaggeration, of couse, as the bank after several days was still standing very nearly vertical, but with slumps at the points where the soil was lightest and the seepage water had come through in largest quantity. These points were at and within a few feet of the culvert at which the break occurred.

It seems evident that the principal reason why the road gang could not stop the flow of water across under the road surface was the saturation of the entire depth down to hard pan by the seepage so that the bank was too soft to hold ordinary piling or filling material, and was ready to go with a minimum of water flowing through along the culvert pipe. The amount of water being augmented progressively by the arrival of overflows from various sources, the destruction shortly became complete.

Method of Repair.—The method of repair is to lay 75 to 100 ft. of tile in the bottom of the cut in each direction at the level of the outcrop of hard-pan in the bottom of the cut near the culvert and surround that with small stone and boulders to form a French drain along and beyond the soft spots developed in the bank; discharge these drains into the bottom of a catch basin some 15 ft. deep, from which a 48-in. cast iron pipe runs across the road and discharges at the toe of the new slope of the fill across the break, 5 to 7 ft. above the ordinary levels of the water in the lake and with a safe and easy channel to it. The cut will be filled up nearly to the former elevation of the ditch and will be seeded as before and will be ample to carry the surface water to the catch basin. The ground water will then be kept drawn down so as to exert little or no pressure on the soil under the road and there should be no danger of the same occurence again.

The evidence is so clear and is on such a scale that it is thought useful to give this description as an aid to theory furnished by observation and a guide to what might be done to prevent such occurrences before the exceptional happens. In the present instance there seems to have been no way to foretell what happened unless some seepage coming out of the bank on the lower (north) side of the bank had been observed and the reason therefor had been hunted out.

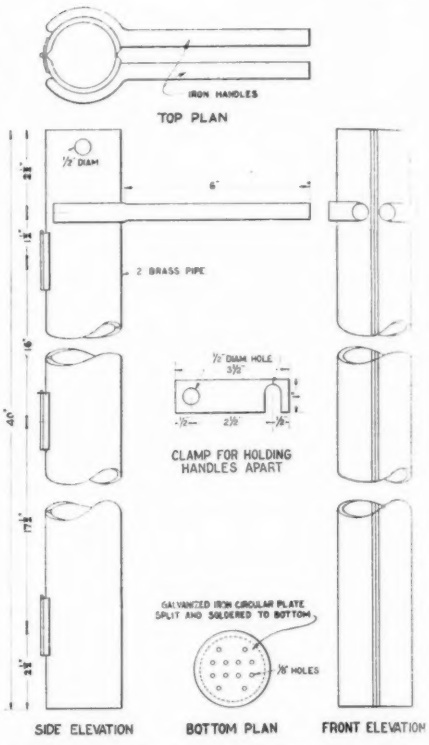
Filter Sand Sampler

There are a number of methods that may be used in collecting sand samples from rapid sand filters for sieve analyses, but the method described below has been found best at the Chain of Rocks filter plant of St. Louis, Mo., for obtaining a representative sample since it eliminates the possibility of mixture of the upper layer of sand with the lower layers.

The collector is a 2-in. split and hinged brass pipe, which is lowered vertically into the filter bed during washing and is then withdrawn after the wash-water has been shut off and the sand bed completely drained.

The clamp shown in the drawing (Fig. 1) is placed over the outer ends of the handles so that the open slit stands apart from ½ to ¾ in. The pipe is lowered into the filter by a rope passing through the ½-in. hole in the top of the pipe. The lowering should not begin until after the full rate of the wash-water in the filter has been attained and then should continue very slowly, the time of lowering to be fully 30 seconds. Afeer allowing the pipe to remain standing on the gravel bed for several minutes, the wash-water should be shut off slowly and the sand bed drained. It is very important that this be done before proceeding.

The clamp can now be released and the handles brought together, closing the split in the pipe. Care should be taken not to exert too much pressure as the sand will tend to rise in the pipe, thus elongating the sample. After withdrawing, the split pipe may be laid out opened on the table, the excess sand from each half of the pipe trimmed off and two samples of filter sand of known volume obtained.



Details of Collector for Sampling Filter Sand

Samples formerly were obtained by driving an angle-iron into the gravel, and then driving another alongside. The two irons were then withdrawn with a section of sand between them. The sand was trimmed off to the edge of the iron and the sand remaining was used as the sample.

Inspection of Fire Hydrants

Hydrant inspection at East Orange, N. J., through cooperation with the fire department. The Board of Water Commissioners have a school for the instruction of firemen as they come new into the service so they will become familiar with each type of hydrant, its operation, and the difficulties that are likely to occur. Every hydrant in this city is numbered. Twice a year the fire department inspects every hydrant. A form made up in card size, 4 by 6 in., which the men can readily carry in their pockets is used. On this card are shown in the different kinds of difficulty that may be encountered. The reports of inspections are turned in to the water commissioners each morning, and inspection and repairs, unless they are major repairs, are made the same day. On the following day the report goes back to the fire chief, and he then knows that the hydrant is in good condition.

Factors in Design of Distribution Systems

Fundamentals Governing the Proper Design

By V. BERNARD SIEMS
Vice President and Chief Engineer, Detwiler & Co., New York City

WHILE distribution systems may be designed to satisfy all of the recognized factors which make for an ideal hydraulic structure, the system which it actually constructed depends largely upon the amount of funds available or upon the attitude of the financiers who supply the capital. In such a situation where the factors given consideration are little more than the construction cost of a system to deliver water for merely domestic purposes, and the design of the distribution system is often justified economically because such justification is based upon incomplete premises—i. e., without due consideration being given all of the factors which should have weight in design. In the division of opinion on this question of first costs versus ultimate benefits, those responsible for design are generally grouped according to whether or not the capital for improvement is supplied by small private interests or by large public utility operators such as the water utility parent companies and municipalities. But notwithstanding this phase of the problem and the knowledge that sometimes in the case of local private companies and small municipalities, the ultimate benefit to be realized from model design is disregarded for the more immediate charm of low first cost, the true economic design which is also the proper physical design of distribution system, depends upon technical factors which are fundamental and hence unchanged, except relatively, by the consideration of cost as a major factor. Therefore, this paper will treat only of the fundamental factors governing proper design of distribution system, although for the purpose of illustrating the economy of proper design, first costs will be discussed.

Elementary Factors That Must Be Known.—Before a study leading to the design of a system is begun certain elementary factors must be known, one of which is the practical objective of the contemplated water system, whether a limited and restricted area is to be served or whether the area has prospects of expanding; and if expansion is reasonably expected, in what manner, at what rate and in what direction such expansion will take place; whether or not the development will be industrial, residential or whether the characteristic growth will be mixed and indeterminate.

Another elementary factor to be recognized is the source of supply. Thought must be given to the available capacity and suitability of supply for the designed use, its general plan of distribution, whether gravity or pumped, the ultimate complete economic development of the chosen source of supply and probable utilization of additional available sources within the period of time considered as a basis for the estimates of future requirements.

A third elementary factor is concerned with metropolitan districting of the water supply utility. Water supply districting and creation of metropolitan utility areas is tardily receiving the attention which this necessary outcome of our population tendency deserves and is following the load of giant electric utility development work under the fostering influence of water utility parent companies controlled by private capital. Hence in designing a system, sight must not be lost of the relation which the system will bear to neighboring communities with or without public water supply and the water supply district within whose boundaries it will be located, nor of whether or not such a district is already organized and water supply sources controlled through previous allocation.

The above mentioned factors are then the general phases of the problem of designing distribution system which must be introduced and investigated thoroughly for a broader understanding of the complete problem before beginning the detail work on the design. Yet while these general factors are important in determining the nature of the source and its usefulness to meet demands of future growth, the total capacity demand to be distributed, the total capacity and the most advantageous position geographically of primary feeders, reservoirs, pumping stations and filling plants, there are other factors which more directly concern the distribution gridiron.

Fire Protection Water Requirement.—In the January issue of The Journal of the American Water Works Association, a paper by the present writer was published which covered a study of distribution design by which future fire protection water requirements was made the basic principle of design. The study embraced investigations to determine, first—the quantity of water used in combating fires of varying magnitude in various types of buildings and characters of developments or neighborhoods; second—the factors altering those quantities; third—the relationship between those quantities and the quantities representing domestic consumption in the various characteristic neighborhoods or developments; fourth—the forecast of changing neighborhoods and the effect of zoning restrictions in neighborhood changes, future growth and characteristics; fifth—the economy of basing distribution system design upon future requirements; and sixth—a method of calculating the probable future maximum water requirements. The investigations were pursued in a rather thorough-going manner in various areas of Baltimore city and environs, certain phases being conducted in cooperation with the engineers of the National Board of Fire Underwriters who were desirous of modifying the accepted but questionable practice of basing fire protection water requirements upon the single factor of population supplied.

The outcome of the study was the establishment by the writers of the fire protection water requirement based upon the estimated future growth and characteristic development of a community as the fundamental principle governing the design of distribution system. A formula was evolved which expressed in equational form this principle and which had as its factors the probable fire area involved in a serious fire in any neighborhood, the height of building, combustibility, the fire apparatus response and a correction factor known as the Baltimore Equation and developed by the writers to apply to the above a relative value for conflagration or exposure hazard. The tendency of the formula was to render more reasonable the requirements which would be placed upon a water system according to the method employed by the Underwriters. Yet the requirements as calculated by this method were sufficient to satisfy most liberal design for it made allowances for the character of the future development anticipated in determining the basic fire area.

In the beginning, the application of the principle expressed by the new formula was restricted to the design of the distribution system of the Baltimore Water Works but the method has since been given a wider application and other and more enterprising studies have been conducted into the basic principles controlling proper design. These studies have covered both large

and small, privately operated and publicly operated water works system with the result that the writers are now prepared to offer modifications to their earlier findings.

Phases Bearing on Distribution Design.—Since 1924 the idea of metropolitan water supply districting has become manifest; statistical observations of the use and life of industrial water supply sources inland and on the seacoast are available; the principle of economic development of one water source for water supply and for waste disposal has become better understood and applied, and the benefits of zoning for utility development have been recognized and use made of zoning regulations to control community expansion. All of these phases have a bearing to some degree upon the general considerations of distribution system design. Observations of residential domestic water demand peaks have enabled the writers to work out a relationship between average daily, maximum daily and peak consumption and a comparison between peak domestic demand and fire protection water demand. It has been found that this relationship throws a new light on the subject of design fundamentals and hence has an important and direct bearing upon the principle of gridiron and distribution system design. For these reasons the writers present a new or revised formula which they believe will aid in establishing a scientific rule for standardizing distribution system design within moderate capacity limits.

Capacity Demand.—In applying the 1924 method it was found that while it made the capacity demand of a large town somewhat less and more reasonable, yet usually in the case of a small town the demand still remained too great to be of practical use for controlling design. After a series of observations it was determined that this inconsistency was due to the predominating character of community development with respect to total and daily per capita water consumption. That is to say, in the large town or in any business community or area isolated for the purpose of investigation, the major portion of the total consumption is found to be consumed industrially or for commercial uses and the per capita consumption is relatively high. In these cases building areas are large and congested, and the fire hazard great. Total water consumption is uniform from day to day and is not seasonable; it does not reflect the ordinary dry or hot weather increase and being predominantly industrial the normal changes in domestic consumption rates have no appreciable effect upon it. Thus where the total water consumed is not subjected to domestic peak rates that are abnormal as compared to the daily 24-hour rate cycle, the quantity of water required for fire protection represents the maximum demand to be placed upon a gridiron and hence is the controlling factor of adequate design.

On the other hand, in residential neighborhoods and predominately residential small towns, where the water consumption is predominately domestic, the day to day rates vary considerably; dry or hot weather peaks are reached that are quite incomparable to the average maximum consumption rate. In these sections the fire hazard is slight insofar as serious fires are concerned as the fire areas are small and fairly isolated. Thus when dealing with a distribution system designed to supply predominately domestic demands it was found that insufficient capacity would be obtained if the fundamental of design was made the fire protection water requirements. Statistics gathered during a period of five years indicate, when analyzed and averaged, that for residential communities average daily consumption X 1.5—maximum daily consumption average daily consumption X 2.0—peak rate of draft. It should be borne in mind, however, that these multipliers represent averages and that the individual case may vary above or below the average. Such variations will depend largely upon the rate charged for water consumed and whether or not the service supplies are metered. Ordinary use of water as well as leakage and waste increases if the cost is too low to encourage plumbing inspection and repair or frugal consumption by the consumer.

Factors Affecting Average Daily Consumption.—If unknown, the average daily consumption can only be actually measured or guessed for it depends upon so many variable factors. But if it is known, that for any future year may be estimated by applying a capita consumption figure to estimated population, provided consideration is given to all other factors that affect total consumption. Such factors among others, perhaps local in nature are: (a) the cost of water to consumers and possible rate changes; (b) the racial characteristics of the consumers influencing their use of a purchased commodity; (c) weather and meteorological characteristics of the community; (d) the conservation measures practiced by the water utility and possible changes in policy; (e) the possible effect of the development of other domestic utilities such as a public sewerage and disposal, street washing or other increased public use of water. But having established the average daily consumption estimate, the maximum for which to design the distribution system should be the above mentioned peak rate of draft for the future year which represents the limit of economic investment in the improvement contemplated.

For the large town, except in the case of pure residential zones, or for industrial and transitional zones, the calculated future fire protection water requirement should be chosen as the design fundamental. The method followed in calculating the capacity of the distribution system should be that detailed in the 1924 paper by the present writers, bearing in mind that it is of prime importance to estimate the character of future growth accurately. No reason is seen at this time for altering the formula details of the earlier work, although some values of the graphs have been revised and the diagrams put in somewhat different form. The only change suggested in regard to the method is that its application be restricted to large towns, industrial areas and factory settlements. In the case of the town showing present mixed development characteristics one or the other of these two methods is to be applied. The reason for no compromise in the selection of the proper design fundamental is that, by virtue of the present development showing mixed character, the area can be assumed to be in a transitional state. It should, therefore, show a tendency toward either residential or industrial predomination and hence determination of the future characteristics is possible. Usually the community showing mixed characteristics is undergoing transition from low value to high value congestion of population and property.

Three Major Categories.—Thus the design of distribution system falls into three major categories, 1st, the importance and relation of the contemplated system in the general scheme of water supply development for its particular geographic area, 2nd, the character and future possibilities of the community for which the system is contemplated, 3rd, calculation of the required capacity of the system in accordance with one of the above described methods, based upon the development characteristics of the community to be supplied.

The first and second are more or less abstract, but a limit may be set for the number of years in the future to which the estimate of the character and future possibilities of the community is carried or projected. This limit will be determined by the economic amortization of the investment to be made. With a definite year limit, the estimates for the future may be fixed with a fair degree of accuracy.

Concerning the first costs of the construction of the system designed by the community served, both the domestic and the fire protection peak demands are met for other class of development, the greater demand being chosen in either case. The domestic peak demand, which as has been shown in the controlling factory for the predominately residential community, is a more tangible requirement upon which to base design than the probable fire protection water demand, because the former is the primary requisite for any water works, i. e., the supplying of sufficient water for domestic purposes.

Hence the cost of the system designed to supply the domestic demand need not be defended since it is an unalterable necessity.

The Case of the Industrial Community.—In the case of the industrial community, however, where fire protection and water requirement is the controlling factor, it is perhaps necessary to justify the first cost of the system designed to meet that requirement. The per cent cost of a public water system for fire protection is not great. It may be found by reference to the formula $Y = \frac{147}{XO.31} - 12.1$, in which Y equals per cent of total cost and X equals population in thousands. But this cost is inversely proportional to population and hence relatively greater for the small town than for the larger. Nevertheless, the relative cost for the small town is not prohibitive but in reality small as compared to the benefits of lower insurance premiums, provision against the loss of life by fire, the economic waste resulting from loss in business and unemployment and in property damage. The small town is usually dependent upon one industry which if crippled would destroy the economic life of the town itself. Furthermore, the system designed to serve the fire demand obviates the necessity of operating and maintaining house pumps in high buildings having large consumption drafts, but still more important, the construction of mains of size sufficient to serve for a reasonable future life saves the added cost of replacement by larger mains after only a few years of use.

In this paper pumping stations will not be discussed as they are considered as part of the general water supply system rather than of the distribution system. Let it suffice to say that in the properly designed distribution system which is well balanced, mains will be sufficiently large to support extraordinary drafts whether or not the pumping station serving the system is operating.

Storage and the consequent pressure support afforded by balancing reservoirs or standpipes is important as it is considered a part of the distribution system. Balancing reservoirs, particularly at the ends of long feeder mains and at the extreme boundaries of service zones are automatic pressure adapters maintaining uniform performance of the distribution system under varying conditions of draft. The presence of these adapters on the system makes possible the use of smaller feeders without increasing friction losses or adding other detriments to the service. These reservoirs also provide reserve storage to carry over chance periods of pump outages, etc., but for better distribution results it is recommended storage to be distributed among several smaller reservoirs rather than in single large capacity balancing reservoir. Both balancing reservoir storage and pumping station capacity should be sufficient, either one in the absence or during the outage of the other, to serve adequately the system whose primary main sizes have been fixed by the calculated maximum demands.

Although the system may be adequately designed by the methods herein described, it should be made further reliable by the provision of a sufficient number of line valves so placed to render maintenance of the pipe system practical and efficient, and to reasonably guarantee continuity of service by guarding against having long lines of main out of service by shutouts for any purpose. The proper number and distribution of valves is commensurate in importance to the provision of duplicate supply lines and looped feeder or primary distribution mains.

For protection of the water utility from liability for damage due to broken mains, because of the greater likelihood of broken mains where traffic is heavy and because of the congestion and importance of consumers, valves on distributing mains in congestion high value sections should be spaced at intervals not exceeding 500 ft. In other sections the spacing may be 800 ft., while on feeder mains the spacing may be increased to 1,200 ft. The required valves should be located at intersections and there should be at least three valves at each fourway branch on mains of approximately the same size.

Fire Protection System.—For the system that is designed on the basis of the fire protection water requirements, it is important that the capacity of the system be available as discharge from fire hydrants. Hence an adequate number of hydrants should be provided and so located as to concentrate discharge quantities where needed. No better spacing could be recommended than that in the code of the National Board of Fire Underwriters; which having determined the quantity of water necessary for fire protection of a characteristic area, assume a discharge of 500 gallons a minute from each hydrant and so determine the number necessary. It is true that the modern fire pumper discharges 750 to 1,000 gallons per minute, but to make the use of the hydrants more flexible it is recommended that the single hydrant be taken at 500 gallons discharge. Symmetry and system should be observed in the actual location of the hydrants. They should be placed at intersections in order to receive the advantage of the support of the tie-in mains and also to facilitate quick location by fire fighting forces. For the latter reason also they should be arranged symmetrically along a line of mains and should be placed on alternate sides of the highway to divide the possible necessity of carrying hose leads across traffic. All fire hydrant branches should be provided with valves for shutoffs in case of damage to the hydrant.

Wherever it is impracticable to support long feeder or important transmission mains with lateral mains and gridirons, duplicate feeders should be provided. These looped feeders improve the capacity and efficiency of the system and likewise are a guaranty against interruption of supply and an aid to maintenance; they are the keystone of the water distribution system.

Finally, excellent design fails if the distribution system when constructed properly and in service is adequately maintained, because of the prime importance of this phase of water works and the dependence upon it for the justification of distribution design, it is here brought to the attention of the reader. Efficient and constant maintenance must be provided if the entire benefit of an adequate distribution system is to be realized and the return on an investment in a properly designed and constructed system is to be enjoyed. A great aid to efficient maintenance is a systemized method of recording construction plans and distribution system changes, revisions and improvements. Record plates should be maintained accurately up to date showing all important parts and appurtenances of the system, and measurements.

The design of distribution system should not be discussed unless zoning is mentioned. In a community where a well regulated zoning law is practiced the work of the designer of distribution system is greatly simplified because he can more accurately foretell the type of future development of areas of population. Zoning therefore is a factor in that it reduces the degree of error in estimates of future possibilities, and hence is a guarantee against costly replacements and enlargements in later years.

In proceeding with the mechanics of design determine whether or not the community to be served will be predominately residential at the termination of the period of time considered economic for the proposed investment. If the characteristics will be residential, calculate the average daily consumption allowing 50 to 85 gallons daily per capita depending upon whether the area is purely residential or residential with small minor mercantile centers, and basing population upon estimated rate of future growth. Multiply the average daily consumption so calculated by 2 to obtain the required capacity of the gridiron. Design feeder mains of a size sufficient to deliver the required quantity to the gridiron at a velocity not greater than the critical velocity. Design secondary grid of 6 and 8 in. mains where tie-ins are greater than 1,000 ft. apart, and of 6 in. mains where secondary grid is closely tied in.

Type of Development.—If the char-

acteristics will be commercial or industrial or mixed, the process to be followed is somewhat more complicated. In developments of these classes it becomes necessary to determine to what degree the development is commercial or industrial. As a business community is a relatively unstable one, inasmuch as it changes to a more congested class reaching its limits of density in the high value commercial district, a schedule to enable to the grading of such communities is here given and the various classes defined.

1st commercial: transitional from residential representing a division of 60 per cent to 40 per cent residential.
Typical store front dwellings and minor congested areas of business houses.

Average commercial: distinctly showing business preponderance, few dwellings, some apartments and flats over business houses. Congested smaller commercial and minor mercantile areas predominate.

2nd commercial: congested pure commercial; large buildings.

High value commercial: nucleus of the business section; highly congested; most dense property value; greatest fire hazard and exposure to conflagration.

Industrial: industrial plants grouped more or less closely; individual hazards may be high by exposure not so great because of areas of vacant land or of water.

It is not good policy to assume an arbitrary demand for the purpose of determining the gridiron capacity for which to design; it is more accurate to calculate each individual problem.

Acknowledgment.—The above is an abstract of a paper presented Sept. 20 at the 47th Annual Convention of the New England Water Works Association.

Retirement Systems for Municipal Employees.—The October Monthly Labor Review of the U. S. Department of Labor contains an interesting article on this subject. As part of the general study of retirement systems for employees in various branches of state and municipal service a study was made of the systems in effect for police and firemen. Retirement systems for these employees exist in most cities and in addition to retirement allowances for members they usually include provision for the dependents of the members. The investigation covered cities having a population of 400,000 and over, and only one city was found in which there was no plan for permitting the police to retire on allowance. Of special interest are the dismissal allowances which are provided by two of the cities after a certain length of service.

Disposal of Small Volumes of Sewage

Simple Applications of Fundamental Principles of Sewage Treatment

By C. G. GILLESPIE
Chief Bureau of Sanitary Engineering, California State Department of Public Works, Sacramento, Calif.

Two practical methods for the disposal of small volumes of sewage have come to the attention of the writer. In both cases rather crude but ingenious schemes were adopted at very small cost.

How the Carmel District Handled Its Problem.—The Carmel Sanitary District of California was faced with the problem of disposing of its septic tank effluent several years ago. This tank was built in the coarse sand dunes of one of its beaches, on a blue gem of a bay. The effluent ditch, which formerly discharged directly into the bay, was filled with sludge and overgrown with weeds so that the septic effluent dribbled to the sea over the beach, creating odors and a nuisance throughout its entire course.

A proposal for dispersal through a tunnel to the deeper water was very costly, running over a million dollars. An activated sludge plant for inland disposal was also excessively expensive. The population of the district was approximately 4,000 with a flow of sewage varying from 50,000 gal. per day in winter to 80,000 g.p.d. in summer.

The president of the district, Dr. William Tower, modified an idea of the writer's in such a way that the problem was solved successfully and at a very low expense. The original idea was to parallel the shore with a long, narrow, open cesspool in the sand dunes. Check weirs were suggested for retardation of flow, but Dr. Tower laid out the pool in such a way that it formed a series of terraces, 15 ft. wide and 20 ft. long, sloping 4 in., in their length of 20 ft., to 2 by 4 in. nosings. There were two units of these terraces made up of five steps of 15 by 20 ft. each, or a total of 3,000 sq. ft.

When the beds were put into use it developed that the slope of the surface was just sufficient to cause some movement of the sand grains. The sand was very coarse, resembling a fine graded concrete sand, with approximately 0.3 mm. effective size and 2.5 to 3.0 uniformity coefficient. The rolling movement of the grains cut away or loosened most of the slimy covering which would usually seal a sand bed in a short time if dosed at this high rate. The sloping surface aided the flow of sewage and scouring action of the sand.

One set of terraces takes the sewage flow for a week easily, there is no ponding, and the sewage sinks away in a few seconds after it is shut off. The sand can be immediately raked over or resurfaced. The water plane is 10 or 12 ft. below the surface.

Another novel feature of this plant is a separate sludge digestion tank for partially digested sludge from the septic tank.

Unique Local Conditions Taken Advantage Of.—Another case where advantage was taken of unique local conditions occurred at the town of Vacaville, Calif. Effluent from its septic tank was creating a nuisance in a nearby gulley. Investment in a trickling filter would have been quite expensive. The town engineer suggested that it might be possible to pass the settled sewage over the local sewage farm in such a manner that it could be stored in ponds without nuisance during the dry months.

Following his suggestion the septic tank effluent was run into a header ditch, into the banks of which were inserted a number of pipe ports at intervals of 15 or 20 ft. The clarified sewage was released through these ports in a thin sheet which flowed through a thick growth of grass down a slope of about 1 ft. per 100 ft. The soil was quite unfavorable, being the tightest of gumbo or adobe, so that it is doubtful if much of the sewage soaked into the ground, but most of it was undoubtedly lost by evaporation and use by luxuriant growth of grass.

The sewage flow is about 125,000 gal. per day, the area of the farm 8 acres. The ponds hold 3.5 million gallons. In the eight months dry period, when the sewage must be held back, some 30 millions gallons of sewage was discharged but not more than 3 million gallons ever accumulated in the ponds.

The effluent after passing over the sloping farm and before entering the ponds appeared to be equal to a trickling filter effluent. It did not putrefy nor become a nuisance in the impounding ponds.

This simple solution of Vacaville's problem utilized some of the fundamental principles of sewage treatment, namely, removal of colloids by the straining action of the heavy growth of grass, aeration and re-aeration by absorption of oxygen in thin sheets, and finally photosynthesis by prolific growth of algae.

Acknowledgment.—The foregoing is taken from the Sewage Works Journal, the official publication of the Federation of Sewage Works Associations.

$700,000,000 of Bond Issues.—According to a survey made by the Bond Buyer bond proposals in cities, towns, counties, and states that came before the voters on Nov. 6 aggregate nearly $700,000,000.

Design of Sheet Asphalt Mixtures for Adaptation to Special Traffic Conditions

Voidage and Shear Tests Advanced for Determining Stability

By GENE ABSON

Chicago Paving Laboratory, Inc., Consulting and Inspecting Engineers

ASPHALT paving mixtures can be satisfactorily adapted to almost any condition of traffic, providing that in the adaptation, instead of following an arbitrary "hit or miss" formula, if some preknowledge of the behavior of the mixture be available. If this forecast of the future behavior of a pavement mixture were not possible, no scientific advancement would ever be made in the art, and mixtures doomed to early failure would still be employed. With this in mind, the following brief description of one particular instance will show the general purpose of such development.

The sheet asphalt pavement section of Michigan Avenue, Chicago, from Lake Street north over the Link Bridge to Chicago Avenue, has developed in the last six or seven years very prominent and deep ruts along the curb quarter where the heavy, solid-tired busses travel in the same tracks almost constantly. The reason for thus rutting, which is NOT an inherent or unpreventable fault of properly designed sheet mixtures, will at once be apparent from the following analysis of the mixture from a rutted section:

Bitumen	11.7%
Passing 200-mesh	17.0%
Passing 80-mesh	27.5%
Passing 40-mesh	35.2%
Passing 10-mesh	8.6%

Other samples from the same source have shown as high as 13 per cent bitumen. The bitumen is greatly in excess of the requirement of rational design for the type and volume of traffic this pavement receives. The fact that at summer temperatures such a poorly balanced, excessively rich mixture possesses very low stability is the reason for the displacement which has taken place.

Fig. 2—Typical Ruts and Waving on Michigan Avenue, Chicago, at Ontario Street. Waving Caused by Busses Stopping

Fig. 1—Typical Ruts on Michigan Avenue, Chicago, Just North of Bridge

When this mixture was designed, if it ever were designed, proper determination of stability would have precluded the possibility of ever actually laying such an inferior mixture, by the simple expedient of forecasting that the stability or resistance to shear would be too low for the anticipated traffic.

In making repairs to the rutted areas during the past several years, no relief has been found, since equally inferior mixtures were replaced and the same results necessarily followed.

When repairs were to be made again this year, the problem placed before us was that of designing a mixture which would resist this rutting. Past experience in designing similar mixtures, as well as the results of extended laboratory investigations in the development of the shear test for stability values have proven to us that high stability could be obtained by using rather high percentages of filler with a well graded aggregate and keeping the bitumen content at a minimum just necessary to fill the voids in the dry, compacted aggregate. This is more desirable than resorting to such artificial expedients as using an abnormally hard asphalt cement in a relatively unstable mixture. Consequently the first step in designing

this mixture was to make voidage tests on the sand to be used in combination with 25 per cent by weight of limestone dust filler in terms of final mixture, by compacting in a steel, cylindrical voidmeter to refusal, then, by mathematical calculations, having previously determined the specific gravities of the three constituents, the amount of bitumen necessary to just fill the voids is readily computed. Such mixtures were then actually prepared in the laboratory and cylindrical specimens 2 in. in diameter molded on a hydraulic press and tested for shear strength in pounds per square inch at 140° F. All this procedure is in accordance with the regular method known as the "Chicago Paving Laboratory Shear Test," and which has been described in previous papers. The pertinent data are given below:

Materials

Sand: Grading as received:	
Passing 80-mesh	26.9%
Passing 40-mesh	39.3%
Passing 10-mesh	33.8%
Filler: Grading as received:	
Passing 200-mesh	86.4%
Passing 80-mesh	13.6%
Specific gravities at 77° F.:	
Sand	2.63%
Filler	2.71%
Asphalt cement	1.04%

Voidage Determination

27.7% filler, 72.3% sand, compacted, gives 17.98% voids.

Bitumen calculated necessary to fill voids, 7.9%.

Shear Tests

Average specific gravity of compressed cylinders	2.230
Average shear in pounds per square inch	55.0
Typical analysis of cylinders:	
Bitumen	8.2%
Passing 200-mesh	25.1%
Passing 80-mesh	20.5%
Passing 40-mesh	22.8%
Passing 10-mesh	23.4%

In plant operation no difficulty whatever was encountered in preparation of the mixture. Analysis of a random sample of the actual mixture is as follows:

Bitumen	8.1%
Passing 200-mesh	25.1%
Passing 80-mesh	21.2%
Passing 40-mesh	24.2%
Passing 10-mesh	21.4%

In handling this mixture on the street, it could readily be observed that the workability was far superior to that of the previous rich and bally mixtures. In some instances, where a batch or two contained a slight excess of bitumen of only 0.3 per cent, the difference was readily apparent, but within this range no excessive gumminess resulted.

Mixtures of this kind, with high filler content, properly proportioned as to bitumen percentage, have previously proven their stability over a number of years in withstanding the severest kinds of traffic.

State Police Recommended for Ohio.—The Ohio State Chamber of Commerce has recommended that a state rural police system be established. The report recommends that a force of from 100 to 200 men be appointed by the governor to enforce traffic laws on state highways. There are at present 14 states which have a state police system.

Subdrainage at Airports

Subdrainage pipe especially adapted for airport drainage was exhibited at the recent International Aeronautical Exposition, Chicago, by the Armco Culvert Mfrs. Association, Middletown, O. This type of drain consists of corrugated iron pipe similar to that used for more than 22 years in highway, railway and municipal drainage, but with perforations in the valley of each corrugation for a portion of its circumference. The qualities of this product, which are stated to appeal especially to airport officials and to aviators, are its non-crushability, frost-resistance and its ability to collect water rapidly.

The high drainage capacity of Armco perforated pipe is said to be due to the small, closely spaced holes distributed throughout its entire length. There are no open joints, nor can the pipe separate or disalign in service. By placing the pipe with the perforations downward water is admitted freely, while roots and soil are effectively excluded. The Armco ingot iron of which the pipe is made assures rust-resistance and durability.

Evidence of the effectiveness of Armco perforated pipe was presented in a display showing its having been used in the drainage of a number of airports, including some, like the Buffalo airport, said to be the safest in the country. The exhibit was in the charge of A. S. Rosing, Publicity Manager, with C. M. Colvin, H. E. Senf and George E. Shafer of the Association's engineering staff in attendance.

Armco Perforated Pipe Being Installed for Subsurface Drainage at Municipal Airport, Buffalo, N. Y.

New Ohio Sanitation Manual

The Ohio State Department of Health, Columbus, O., has recently published a revised bulletin under the title, "A Manual of Water Supply Sewerage and Sewage Treatment for Public Buildings in Ohio." This manual supplants one published in 1916, now obsolete in view of modern practices. The new manual contains statutes and regulations governing the construction of sewerage and sewage treatment plants and the submission of plans relative thereto. In addition, descriptive matter and plates are included to serve as a guide to the uninitiated in the preparation of plans for submision. Proper developments of water supplies are outlined and shown pictorially. The distribution of this bulletin is only to those having specific interest in the subject, and on request.

The Traffic Preblems of Pittsburgh, Pennsylvania

How the City Has Organized to Meet Traffic Situation

By PROF. LEWIS W. McINTYRE

Street Traffic Specialist, Consulting Highway and Highway Transport Engineer

AN adequate study of traffic today is not merely one of parking, signs and police regulations, but must cover about five main elements. These are:

1. Improving the city plan.
2. Zoning and decentralization.
3. Mass transportation service.
4. Railroad terminal practice.
5. Traffic organization and control—vehicle and pedestrian.

Improving the City Plan.—The problem of city planning today is not to lay out new cities, but to adapt existing cities to the needs of traffic so unexpectedly thrown upon them. A good city plan should provide: (1) the easiest means of reaching each center, (2) the easiest means of passing through each center, and (3) the easiest means of avoiding each center. Obviously such rebuilding of cities is a slow and expensive process, but citizens should insist that all improvements conform to a definite and well thought out plan and not be constructed haphazardly.

Zoning.—Zoning is also of little or no effect as an immediate aid in relieving congestion, but will be in the future. Its effect is a matter of decades, if not of generations. Its largest contribution in relieving traffic congestions will be found in its use to forestall concentration of traffic producing enterprises in narrowly confined areas, thereby decentralizing traffic through reducing the need for transportation.

Mass Transportation Service.—In entering Downtown Pittsburgh, 75 per cent of the people use one of the mass transportation agencies. The street car makes up 12 per cent of the passenger-carrying, street-using vehicles, but carries 70 per cent of the street passengers; the private automobile constitutes 87 per cent of the passenger-carrying, street-using vehicles, but only carries 29 per cent of the street passengers. These figures indicate that concentration certainly requires mass transportation. Rapid transit must also not be overlooked. A proper perspective of the transport picture involves the coordination of all forms of transportation into a well integrated whole.

Railroad Terminal Practice.—Most persons, particularly railroad men, regard the private automobile as the principal offender in causing traffic congestion. Railroads have, however, continued to concentrate their local traffic close to the business district, with the result that the streets are unnecessarily cluttered up with cross-town freight movement. The adoption of collection and delivery service by the railroads and the consequent re-location of terminals is another way in which congestion could be reduced and other savings secured through better-organized cartage.

Mr. W. H. Lyford, vice-president of the Chicago & Eastern Illinois R. R., is authority for the following statement: "A distance of two miles between locations of two stations in a large city may make a difference of 300 per cent in the interest charges on the real estate occupied by the two stations. In Chicago the interest charged alone on real estate at Twelfth Street on which a freight station is located is more than $2.50 per ton of freight handled through the station. If the station were located at 33rd Street, such interest charged would be reduced to about 80 ct. per ton. The amount of interest saved by moving the station to 33rd Street would pay the cost of well organized cartage between the 33rd Street station and the premises of the trader. The present cartage charged should be saved." Again, coordination of transportation agencies is necessary for the best and most economical service.

Traffic Organization and Control.—Minor street improvements, improved traffic direction, and restriction of traffic are the three main possibilities for better traffic organization.

Removal of obstructions, larger curb radii at intersections, laying of smoother pavements, narrower sidewalks where roadways are congested and sidewalks are unnecessarily wide are all measures whose expense is clearly justified where they will bring appreciable relief.

Improved traffic direction involves consideration of such questions as the supplementing of police control with electric control, the proper relation of signal duration to traffic volume, the development of one-way streets, traffic circles, boulevard stop regulations, uniform signs, signals and marking, uniform and adequate traffic laws and the enforcement thereof, best means of segregating traffic, horizontally and vertically, through arcaded streets, two level streets, pedestrian tunnels and separated grade crossings, determination of the average parking time demand for different classes of traffic and facilities for each, development of cheap off-street day storage for automobiles—if necessary by municipal undertaking, provision of parking and loading space in or adjacent to new large buildings by voluntary agreement or by law, staggering of business open-

Fourth Ave., Pittsburgh—A 3-Lane Street Reduced to 1 Lane by Parking

ing and closing hours so as to spread the time peak, provision of off-street terminals for motor buses and taxi cabs, etc. It is evident that some of these questions justify much greater comment along technical and economic lines, but space will not permit of their detailed discussion at this time.

An increase in the number of vehicles always retards their speed, but studies have shown that the capacity of the roadway is increased until this speed is reduced to about 15 miles per hour. Further increase in the number of vehicles not only further reduces their speed, but also suppresses traffic by reducing the traffic capacity of the roadway concerned.

Traffic restriction also suppresses traffic, but if properly applied it selects the traffic to be restricted in such a manner that the capacity of the roadway is not reduced. It restricts that traffic which is just worth its cost to those who operate it, so that the minimum economic loss to the community is incurred. In congested districts traffic which is unable to maintain a speed which produces maximum roadway capacity is very costly, when viewed from the standpoint of the tremendous expense necessary to widen existing thoroughfares to increase their capacity, while traffic which can maintain a speed above that which produces maximum use of the roadway need be given comparatively little consideration.

To illustrate: horse-drawn vehicles in downtown Pittsburgh move at an average speed of but 3.2 miles per hour, and make up but 1⅓ per cent of the vehicular traffic during the evening peak period. It is evident that this traffic is suppressing other traffic by reducing the maximum speed of potentially speedier vehicles below that speed which produces maximum street use. Therefore, prohibition of the use of certain streets during the peak period to horse drawn traffic would bring about considerable relief, and a minimum loss to users of such vehicles. At the same time suitable by-pass thoroughfares should be designated for the use of such traffic.

Again, parking cars and unloading freight from trucks at the curb is a most expensive form of street utilization from the standpoint of the space occupied, while the pedestrian probably utilizes the street space most efficiently.

The private automobile carries but 1.87 passengers per car in downtown Pittsburgh, while the street car carries 32.0 passengers per car, or 16.9 times as many. The street car takes about three times as long to clear an intersection as a passenger automobile. Therefore, from the standpoint of intersection capacity, the street car is about six times as efficient in the congested district as the passenger automobile in furnishing transportation to the people. Facts such as these should be the basis for the application of restrictive measures.

A survey of 48 selected stores in downtown Pittsburgh shows that only 2.8 per cent of the patrons on a typical day parked their automobiles at the curb. The United States Department of Commerce in their study of "Vehicular Traffic Congestion and Retail Business" shows the shopping times in large cities to be as folows: less than half hour—52 per cent, one-half to one hour—40 per cent, over one hour—8 per cent. In the Central Business District the number of vehicles found parked over one hour on a typical day was 16.8 per cent. Even during the evening peak period, 5½ per cent of the curb space was constantly occupied by parkers. These figures indicate that business interests will be best served by providing for freer vehicular movement making it easier for the bulk of their patrons to come down town, than by providing increased curb parking facilities for only a very small proportion of their patrons. These curb parked automobiles are acting like a fence around business establishments preventing many potential patrons from driving up, disembarking and shopping. In Chicago The Trucking Exchange estimated that if parking were prohibited in the Central Business District, allowing trucks to reach loading and unloading places more readily equipment could be reduced 25 per cent. This has been done and the results exceed expectations.

Of course, restrictions should be applied under the supervision and upon the recommendation of trained traffic engineers, and not as matters of political expediency. The relative convenience of different types of carriers, the class of persons carried and the effect on the transportation system and on business as a whole must all receive consideration. It is probable, however, that the generally hostile attitude of the public toward restrictions provides a sufficient safeguard against too serious restriction. The fact that restriction of parking and of freight movement in congested areas is being accepted indicates that the pressure of increasing congestion will force submission to the necessities of the situation.

Pittsburgh's Organization for Meeting the Traffic Problem.—To consider the five elements of traffic problem mentioned, Pittsburgh has:

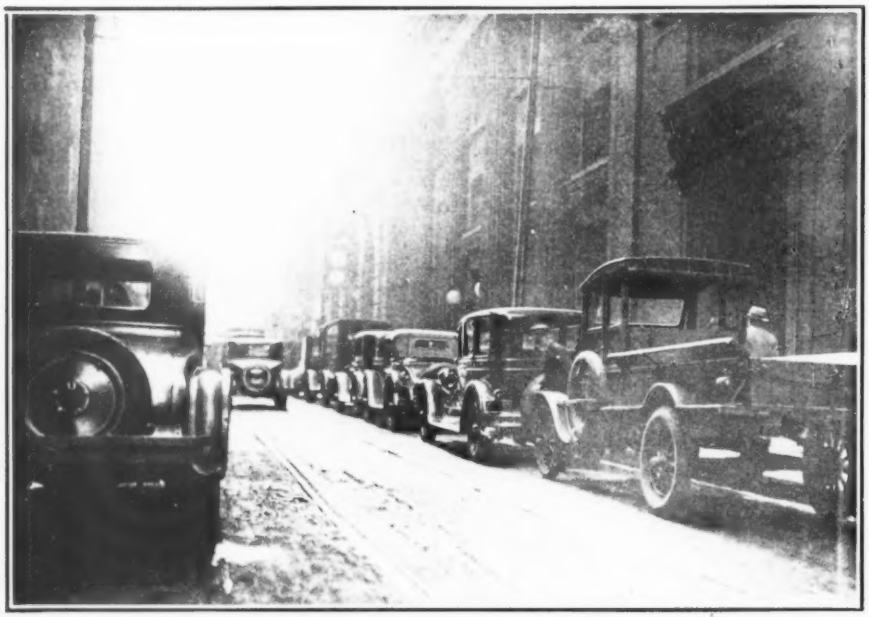
1. The Citizens' Committee on City Plan and the City Planning Commission. The fundamental purpose of these bodies is to produce a comprehensive "Master Plan" of both county and city; indicating the more important requirements of the county area's future development and the individual relationship of various recommended improvements to each other and to the whole.

2. A Zoning law and a Zoning Board. The carefully thought out principles laid down should be adhered to and not subjected to continual sniping in the interests of political expediency, if maximum results for the future are to be secured.

3. A City Transit Commission and a Traction Conference Board. The first of these bodies is studying the question of rapid transit, and the latter governs the relations of the street railway company and the city.

4. Improved railroad terminal practice has received some consideration from the railroad organizations, but there is room for considerable further work from the standpoint of coordination of transportation agencies and the effect on city congestion.

5. For the work of traffic organization and control, Pittsburgh has—under the Director of Public Safety—traffic officers, under the Traffic Inspector, to aid traffic movement and enforce



Diamond St., Pittsburgh—Another 3-Lane Street Reduced to a 1-Lane Street by Parking

traffic regulations, and a Traffic Planning Bureau under the Traffic Engineer. This Bureau makes studies of: traffic accidents—analysis of locations, causes, protective measures; electric traffic signals—their design, location, operation, use in "tied together" control system, etc.; traffic counts, signs, road markings, beacons and other traffic equipment—their design, location and erection. The Mayor appoints the Traffic Magistrate, who has charge of Traffic Court where all traffic cases are handled, and the Better Traffic Committee, a purely voluntary group of some of Pittsburgh's most prominent citizens who give time liberally, advising on traffic improvements and securing the support of the general public.

The Better Traffic Committee functions through four regular standing committees and various special committees formed from time to time as special problems arise. The work of the four standing committees is indicated by their names, which are: Education Committee, Engineering Committee, Law Enforcement Committee and the Traffic Flow Committee. The Committee has had a voice in an advisory capacity in many of the improvements which are making themselves evident, in so far as these affect the movement of traffic and the reduction of accidents.

The Committee sponsored the Central Business District Traffic Survey, realizing that the traffic problem was largely an engineering one, and that its solution would depend upon, to a considerable degree, conclusions derived from facts rather than guess work. In accordance with the recommendations of this Survey, the Council has appropriated $125,000 for a coordinated electric control system for the downtown district based on the design submitted by the Survey. Other recommendations of the Survey yet to be acted upon will undoubtedly produce further improvements.

Acknowledgment.—The above article is taken from the June Pennsylvania Motorist.

Lamp Post Designed to Withstand Severe Impacts

The surprisingly high cost of replacement lamp posts in large cities due to breakages by auto accidents has brought about the development of a lamp post designed to withstand unusually severe impacts. A post developed by the Westinghouse Works at South Bend, Ind., was publicly tested on Oct. 23. It is stated that several blows of 85,000 lb. were delivered before the Hollowspun post, as it is named, was broken. An automobile driven at approximately 30 miles an hour was completely wrecked against one of these posts, the only damage suffered by the post itself being an abrasion caused by impact with the front axle of the car, which had been twisted back as far as the driver's seat.

A feature claimed for this post is that besides being a decorative unit along the drive, even after a most unusual blow which may break it, the post remains standing because of the rail steel inside reinforcement, thus avoiding the added danger of a heavy post falling on passengers within the car or perhaps standersby.

Air Plane "Sign Posts"

The Daniel Guggenheim Fund for the Promotion of Aeronautics has started a nation-wide campaign for roof-markings which will identify the country's towns to the aviator. Such identification is a first requisite for an air transportation system, which will heighten the efficiency of American business by swifter means of communication.

As a basis for the work, the Fund, supported by the Postmaster General, has asked some 8,000 postmasters in towns with a population between 1,000 and 50,000 to take the initiative in seeing that their communities are identified by roof-markings. The postmaster is urged to enlist the support of civic organizations such as the American Legion, the service clubs, or the Chamber of Commerce, or individual corporations. To the organization or person responsible for the identification the Fund has asked Colonel Lindbergh to send a certificate of appreciation. The record of roof-markings will be kept by the Fund and made available to the Department of Commerce, the Post Office Department and other government agencies. The movement has the backing of the Departments of War, Navy and Commerce.

Many corporations throughout the country have already been active in marking the roofs of their own buildings for purposes of aerial navigation. This is not only a civic act helpful to the community in which the corporation is located; it is also a direct benefit to business as a whole, since it is the latter which will benefit particularly from a commercial air transportation system. The Fund asks that a corporation with an available roof in an unmarked town of between 1,000 and 50,000 population should communicate directly with the postmaster.

In a printed bulletin the Fund describes the type of roof most suitable for marking and urges the use of block letters in chrome yellow with a black background. It is suggested that it should be from 10 to 20 ft. in height and on roofs preferably of tiled shingles, tin or other metal, or slate where the visibility is not reduced by smoke. Besides the name of the town or city, the marking should include an arrow pointing due north with the letter "N" over it and a smaller letter indicating the airport if there is one.

The Year in the Cement Industry

Estimating 1928 shipments of portland cement will total 175 million barrels, G. S. Brown, retiring president of the Portland Cement Association, declared in his annual address on Nov. 21 that in spite of the reduced rate of increase over 1927, there is no reason to believe the future outlook is affected.

"The reduced rate of increase reflects very definitely such factors as the slump in building awards during the latter half of 1927, which left a correspondingly smaller construction hangover for 1928," Brown said. "It does not mean that less new business has been developed during the present year or that the future outlook is affected. On the contrary, it is probable there will be a larger carry-over for next year than was available for shipment in 1928.

"In a number of districts new producing capacity has come in and in all districts we are able to make considerably more of our product than we have been able to sell. Nevertheless, I am of the opinion that those companies whose properties are modern and commercially well located, are well supplied with raw materials and are well financed and managed, have in all districts but one shown satisfactory returns.

"This statement must be modified for those mills which ship largely into seacoast territory where low priced foreign cement has forced even the best equipped mills to sell for cost or less," he continued.

Mr. Brown spoke before the 26th annual meeting of the Portland Cement Association, in session at The Blackstone Hotel and attended by representatives of manufacturers who produce over 90 per cent of the cement shipped in the United States. The main theme of his address was a review of results of association activity since the war.

"Public confidence in an industry such as ours is largely a question of public understanding," Brown asserted. "The primary objective of our work has been service to the user. Appreciation on the part of users is unquestionably the greatest factor in the accumulation of public good will.

"Perhaps we are inclined to think too little of the service feature of our Association. With the growing use and number of uses of portland cement, users have been seeking information as never before. The Association as an information bureau, acting for all the portland cement manufacturers, has handled thousands of inquiries which have enabled inquirers to use cement in a satisfactory manner."

In this review he cited 290 million barrels of cement used in road and street paving in the last ten years and 6½ million barrels used in concrete sewer pipe in the last five years.

City Planning Enabling Act Published by Commerce Department

In announcing publication in printed form of "A Standard City Planning Enabling Act," the Department of Commerce reports that with more than 530 cities and towns which it has found to have planning commissions, including more than 200 out of the 300 largest cities, there has been a growing need for carefully devised legislation to enable city and regional planning to be carried out with the best results. It is pointed out that the extent to which planning commissions succeed in promoting early and efficient physical development of land affects in no small degree the return in terms of practical usefulness, now and for years to come, of several hundred million dollars of taxpayers' money spent each year for public improvements, as well as the value and serviceability of new private construction costing several billion dollars each year.

The advisory committee on city planning and zoning of the Department of Commerce commenced preparing this standard act in 1924 in response to many requests from municipal and state officials and private organizations interested in civic affairs. The same committee, which was appointed in 1921 by Secretary Hoover, had already drafted a standard state zoning enabling act, which has been used as a guide in drafting legislation adopted in 29 states.

In a foreword to the pamphlet containing the city planning enabling act, the Department of Commerce states:

"A state legislature, in adopting such an act, grants to cities the authority deemed necessary for effective planning and prescribes certain conditions as to planning organization and procedure.

"The advisory committee members have each had many years of first-hand experience in coping with local planning problems, both as local citizens and in connection with the leading national business, professional, and civic groups which they represent. During their three years' work in drafting this act they have made laborious researches into legal problems and have consulted with expert planners, members of planning commissions, municipal officials, and other interested persons throughout the country.

"The report recommends, first, a clearly defined permanent planning branch in the local government, in the form of a commission which formulates a comprehensive plan and keeps it up to date. The commission then advised the legislative and executive branches of the municipality, and the public, as to the importance of the plan and promotes conformance to it in the laying out of new streets, the construction of public works and utilities, and the private development of land. Close attention was given to every detail here, as elsewhere in the act, that would help make good planning popular and effective.

"The sections devoted to control of new subdivisions are framed with careful regard to constitutionality and aim at procedure which will promote harmony and justice in all relations between the planning commission and the private landowner. The part relating to control of buildings in the bed of mapped streets involved much laborious original work on a special problem.

"The portion on regional planning presents the primary need for bodies to study and define regional problems comprehensively as the first step toward solving them. This procedure tends to forestall mistakes and prevent the gradual growth of conditions that may call for hasty, emergency solutions at extra expense. Regional problems should be thoroughly analyzed and publicly discussed before supplementary or new regional forms of government are set up to cope with them."

A limited preliminary edition was issued in March, 1927, and has already been used by the legislatures of California, Maryland and Pennsylvania in framing laws. The printed edition, now published, contains some improvements in phraseology and some revisions in the notes. Footnotes accompanying every section of the act explain in some detail the reasons underlying many of the recommendations and the phraseology used to convey them.

The committee itself makes the following general statement in regard to the act:

"This act covers the four general subjects which experience has shown to be a necessary part of planning legislation, namely, (1) the making of the city plan and the organization and powers of the city planning commission, (2) control of subdivisions, (3) control of buildings in mapped streets, and (4) regional plan and planning commission.

"Sooner or later every state will need legislation covering all of these four general subjects. The text of this act has been so arranged, however, that any state which feels that it does not desire to include the control of subdivisions or buildings in mapped streets or regional planning or any two or three of these subjects can omit the part or parts for which it does not deem itself ready.

"Legislation concerning the three subjects of subdivision control, mapped streets, and regional planning may be said to be in the trial and error stage. By this is meant that practical experience and judicial decisions upon the legislation have not been sufficiently extensive to enable anyone to be dogmatic about the best or final form of legislation on these subjects. The committee believes that it has worked out provisions which represent the most extensive investigation into and the best prevailing thought on the various features. As stated above, each of these subjects is a necessary part of effective planning legislation, and the text of this act supplies, therefore, a model from which to frame and develop the planning legislation of the various states of the country.

"Some states now have upon their statute books measures to which any new provisions on these subjects would need to be adjusted. Some parts of this act, particularly those relating to mapped streets, involve considerations of and adjustments to constitutional provisions relating to eminent domain, and, as these provisions differ in different states, variations of those parts of the text of this act may be requisite in any particular state to adjust this legislation to the privileges and limitations allowed by or imposed by the constitution of that state as interpreted by its courts. Other adjustments to local decisions on constitutional law, local legislative customs, local modes of expression, or local traditions may prove necessary or advisable.

"Consequently, though this standard act has been prepared after careful study of the legal and administrative problems that arise in planning, it is not meant to be slavishly followed to every word, sentence, or section, but rather to be used as a model and to be followed but with such adjustments as may be dictated by local constitutional and statutory law and legislative customs and tradition.

"In the notes are pointed out many of the places where these problems will arise and need to be taken into account in the final form of the enactment."

The advisory committee on city planning and zoning was constituted as follows:

Charles B. Ball (died Oct. 8, 1928), municipal engineer, secretary-treasurer, City Planning Division, American Society of Civil Engineers; Edward M. Bassett, lawyer, counsel, Zoning Committee of New York; Alfred Bettman, lawyer, American City Planning Institute and National Conference on City Planning; Irving B. Hiett, realtor, ex-president, National Association of Real Estate Boards; John Ihlder, housing consultant, former manager, Civic Development Department of the Chamber of Commerce of the United States; Morris Knowles, consulting engineer, from the Chamber of Commerce of the United States; chairman, City Planning Division, American Society of Civil Engineers; J. Horace McFarland, master printer and civic investigator, ex-president, The American Civic Association; Frederick Law Olmsted, landscape architect, ex-president, The American Society of Landscape Architects; ex-president, American City Planning Institute; Lawrence Veiller, housing expert; secretary and director, The National Housing Association.

The publication may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15 ct. a copy.

Modern Street Lighting Practice

Comparison of Systems and Intensities Now in Use

By C. E. SCHWENGER
Distributing Engineer, Toronto Hydro-Electric System

ORIGINALLY, streets were lighted so that one could see to go about at night; great intensity of illumination was not an important item. Today, however, streets are not lighted for our personal convenience, but to reduce crime, to reduce accidents, to speed up traffic, to increase civic pride, to stimulate business and other activities, and thereby boom or exploit the city itself.

The change in requirement during the last 15 years is largely due to the entrance of the traffic problem. Before that date automobiles were very few. Today, we have many thousands of cars on our streets at all times. The requirement of the automobile driver for good street lighting is now predominant. In 1910, let us say, when most "Hydro" street lighting systems were being designed, there were practically no automobiles and systems were laid out without this very much in mind.

Lighting System in Toronto.—In Toronto, a system using incandescent lamps, 100 watts, 80 c-p. mounted only 9 ft. 6 in. from the roadway, was adopted. This system was used universally over the city except downtown. This mounting height was due to the necessity for placing the lamps below the trimming heights of the trees on the streets; this trimming height in those days being 10 ft. There were few asphalt pavements and less than 1,000 cars, and glare to the driver was not a large factor. However, provision was made against glare by the adoption of a translucent cylinder enclosing the lamp which is so evident in Toronto today. It soon became apparent that higher mounting heights and greater lamp intensities were needed to take care of the gradually growing traffic. At the present time, the Toronto system uses lamps of 100 c-p. at 12-ft. mounting height for residential sections, and still it is necessary to use the translucent glass cylinder to prevent glare. On main thoroughfares greater intensities are now used and these will be discussed later.

Modern High Intensities.—Modern street lighting practice demands that lamps of increasingly large intensities be used and be mounted at such a height and with definite light control equipment as to prevent glare to the automobile driver on the highways of our cities. There are two general methods of reducing glare, namely, by increasing the mounting height and by the use of diffusing or light controlling glassware, and of course, a combination of these.

Recommendations of Illuminating Engineering Society.—It might be well to lay down at this point a few of the adopted recommendations of the Illuminating Engineering Society, as presented by their committee on "Street Lighting" 1927, to which other engineering bodies have agreed.

1st. Resolved—That there are no conditions of street lighting prevailing in the United States which justify the use of smaller than 1,000 lumen lamps and that the 2,500 lumen lamp is the smallest size which may be used with economy.

Also Resolved—That present day Mazda street lighting lamps rated in lumens are substantially the illuminating equivalents of like types of lamps which previously have been rated in candle power of one-tenth numerical value, e. g., a 1,000 lumen lamp is equivalent to a 100 c-p. lamp.

It is recommended that ratings in candlepower which are now antiquated and in some cases may not be reliable, be abandoned in the few cases in which they still obtain, and that lumen ratings which are now standardized for all series lamps, be adopted in their place.

The "lumen" is the unit of light flux and is that flux of light radiating with unit intensity through a unit solid angle.

Lumen output equals the mean spherical candle power multiplied by 4π (12.766).

Comparison of Lamps.—Now let us compare available street lighting lamps.

Knowing the lumens output of the lamps used on various street lighting systems, a convenient way to compare such systems is to do so on the basis of lumens per foot of street. (This does not take into account the efficiency of light distribution on the street).

Such data do not give a relative comparison of the lumens which usefully reach the street. The amount of useful lumens is dependent on the type and efficiency of the light controlling devices. This may be some property inherent in the lamp itself, such as an arc lamp, which throws most of its light downwards, or on reflectors, refractors, globes or other controlling mediums.

Table I—Comparison of Street Lighting Lamps

c-p.	Type	Watts	Lumens
100	6.6 amps.	69	1,000
250	6.6 "	152	2,500
400	6.6 "	244	4,000
600	6.6 "	361	6,000
600	20 "	330	6,000
1,000	20 "	540	10,000
	120 v. Mazda	100 "B"	980
	" " "	100 "C"	1,260
	" " "	150 "C"	1,950
	" " "	200 "C"	3,100
	" " "	250 "C"	3,750
	" " "	300 "C"	4,840
	" " "	500 "C"	8,750
	" " "	1,000 "C"	18,500

Now as a further consideration let us take for example the case of street lighting systems using 1,000 lumen lamps bare with no control devices. In such a case the light distribution is practically uniform in all directions from the lamp and approximately 50 per cent of the light flux (lumens) is directed downward, i. e., 500 lumens are available as useful light for street lighting. Now using a good refractor we may catch the upward flowing light and re-direct it in a downward direction.

Bare lamps (without control devices) will give less glare if greater mounting height is used, but this is not practical in most cases on account of trees, and where the unit is of very high intensity it becomes necessary to mount the lamps at a height altogether too great for convenient maintenance. A small bare lamp, 1,000 lumens, must be mounted at a greater height than 15 ft. to reduce glare to a reasonable value. Large units such as 10,000 lumens, bare, would have to go at least 30 ft. or more from the ground to accomplish the same results.

On the other hand, lighting units using suitable control devices may be mounted considerably lower without

Table II.—Comparison of Street Lighting Installation

Location of Lighting		Unit Lumens		Spacing	Lumens per foot of street
Toronto:	Yonge St., down-town	8,750	mult.	100 ft.	175
	Sunnyside	6,000	series	"	120
	Danforth Ave.	4,840	mult.	"	96.8
	Residential—Double	1,260	"	"	25.2
	Single	1,260	"	"	12.6
Winnipeg:	Memorial Bldg.	30,000	arc	"	600.0
	Local Improvement	10,000	series	150 ft.	70.0
	Residential	10,000	"	325 ft.	32.0
Montreal:	New system	15,000	"	95 ft.	315.0
Brantford:	Main streets	15,000	"	100 ft.	300.0

Table III—Approximate Efficiencies of Control Devices

Controlling Device	Lamp Lumens Bare	Total Lumens Transmitted	Downward Lumens	Efficiency
Reflector (radial wave)	1,000	866	718	71.8
Refractor (band)	1,000	725	666	66.8
Shaped translucent glassware	1,000	760	412	41.2

producing objectionable glare, thus a 1,000 lumen unit with refractor may be mounted at a height of from 12 to 15 ft., and a 10,000 lumen lamp may be mounted as low as 18 ft. These mounting heights make it possible to illuminate the streets where there are trees, and also to use existing poles or reasonably short ornamental pillars. In addition, still lower mounting heights may be used if good diffusing glassware is used.

These recommended intensities are somewhat higher than are used in most parts of the Province of Ontario.

Table VI gives some idea of the present tendency in various cities to high intensities.

There are two generally accepted types of street lighting systems used, namely, the series system with all lamps on a circuit in series with each other and the multiple system having its lamps connected in multiple on the

Table IV—Types and Mounting Heights Used in Toronto

1,260 lumens—100 watt (mult.) radial wave reflector	15	ft.
1,260 " —100 " " diffusing glassware	12	ft.
4,840 " —300 " " " "	15	ft.
8,750 " —500 " " " "	15	ft.
6,000 " —600 c-p. series refractor and disc. glass (Sunnyside)	15	ft.
OTHER INSTALLATIONS		
100,000 lumens, 2,250 watt (mult.) diffusing glassware (Chicago State St.)	22	ft.
15,000 " Luminous Arc. (San Francisco Market St.)	32	ft.
6,000 " 600 c-p. series, Oneida, N. Y., diffusing globe	11½	ft.
6,000 " 600 c-p. series, Allentown, Pa., diffusing globe	14½	ft.
2,500 " 600 c-p. series, Mandan, N. D., diffusing globe	12	ft.

circuit. There is also a small amount of series multiple lighting.

These systems may be installed either overhead with open wire circuits or underground with lead covered cable which may be installed either directly in the ground or in a duct system.

Series System (Ontario).—The series system, as used in Hydro municipalities, has the disadvantage where used overhead of having a small high voltage wire strung from pole to pole and in close proximity to other conductors. The pressure may reach several thousand volts. The multiple system, on the other hand, has a maximum voltage of that of the lamps (120 volts). The series system requires constant current transformers which operate at a comparatively low power-factor as compared to constant voltage transformers supplying a multiple system. The power-factor on the series system is less than 70 per cent as against 95 per cent power-factor on multiple system. This low power-factor practically cancels the advantage the series lamp has, through greater efficiency, over the multiple lamp.

There is not much to choose between the series or multiple system in initial capital costs as constant current transformers are several times the price of corresponding constant potential transformers. This increased cost about cancels the saving in series system where only one wire is used on the multiple system.

While at present there are throughout America a predominating number of series systems, there is a growing percentage of multiple systems being installed, e. g., Minneapolis, Vancouver, Milwaukee, Chicago.

Multiple System.—From an operating viewpoint the multiple system has certain advantages. On such a system as used in Toronto, the loss of a street lighting transformer is handled in an emergency by cutting the multiple network clear of the defective transformer and obtaining temporary supply for the street lighting from the house lighting mains which everywhere parallel the street lighting secondaries.

This flexibility does not exist where the series system is used.

With a multiple system extensions may be made with ease as compared to the series system. A wire break or cable fault is not so likely to extinguish all the lamps as would be the case with series lighting.

Extra business, such as advertising sign loads, traffic signs, danger signals, fire alarm boxes, signal lights, etc., are readily supplied by the multiple system without expensive changes to the existing system. These are difficult loads to handle on a series system.

To give some idea of the business exclusive of regular street lighting, which may be added to the street lighting system, Table VII is given.

Special Type of Street Lighting.—Railway crossings are specially marked by flood lighting arrangement which shows up plainly the tracks and gates, etc.

Traffic police officers are assisted at intersections by means of larger lamps mounted over the center of intersections. This lighting makes the officer plainly visible to motorists.

Street intersections are also sometimes illuminated with larger lamps mounted at the intersections higher than on adjacent poles. This is a decided convenience to automobile traffic.

Another tendency is that on account of traffic requirements the old moonlight schedule for street lighting hours has become obsolete and a sunset, sunrise schedule is almost universally used.

Where shade trees are newly planted along city streets, the street lighting requirement should receive consideration. In Toronto, the practice of the Forestry Dept. is to plant shade trees behind the sidewalks at intervals of 45 ft. No trees are planted within 45 ft. of the street corners. This gives intersections clear of foliage when the trees grow up.

Acknowledgment.—The above is taken from a paper presented at A. M. E. U. Convention at Niagara Falls.

Table V—Recommended Modern Practice

	Type	Lumens per ft. of street
Large cities 100,000 population or greater	Heavy traffic streets	400 to 1,000
	Medium traffic streets	200 to 500
	Residential streets	15 to 30
	Alleys	15 to 30
Smaller cities	Heavy traffic streets	300 to 500
	Medium traffic streets	200 to 300
	Residential streets	15 to 30
	Alleys	3 to 8
Small towns	Main business streets	80 to 200
	Residential streets	8 to 15
	Alleys	3 to 8

Table VI—Examples of Street Lighting Intensities

City	Lumens per ft. of street
Cleveland (Superior Ave.)	500
Los Angeles (Broadway)	510
Minneapolis (business section)	520
Portland, Ore. (business section)	600
San Francisco (Market St.)	750
Niagara Falls, N. Y. (Falls St.)	750
Salt Lake City (business section)	820
Chicago (State St.)	2,000

Table VII—Business Added to Street Lighting System for Toronto

	Number
Advertising signs, 500 kw. total load	840
Street traffic signs, detours, quiet zone, No Parking, etc.	127
Private lights—apartment house entrances, courts, etc.	107
Street railway, signal lights for intersections, loops, lavatories, etc.	725
School yard lights (morality lights)	15
Public lavatories	38
Store front lighting, stores	20
Fire alarm signal lights	329

Standard Size of Fields for Games

Rugby Football	225 ft. x 330 ft.
American Football	160 ft. x 360 ft.
Hockey	150 ft. x 225 ft.
Soccer	180 ft. x 300 ft.
Golf Driving Net	12 ft. x 25 ft.
Volley Ball	25 ft. x 30 ft.
Horseshoe Court 12 ft. x 52 ft. (stakes 40 ft. apart)	
Baseball—90 ft. between bases, field limits 235 ft.	
Tennis	36 ft. x 120 ft.
Handball	20 ft. x 36 ft.
Basketball	50 ft. x 70 ft.
Paddle Tennis	18 ft. x 30 ft.
Outdoor Bowling Green	40 yards square
Each individual rink	19 to 20 ft. wide
Boccie	18 ft. x 60 ft.
Pelota	Stone wall 30 ft. high 55 ft. wide
Ground	55 ft. x 250 ft.

Obtaining Sand from Sludge Bed Area

Sand Washing Plant at Tannersville, N. Y., Works

AN interesting design of sand washing plant was used in the construction of sewerage for the village of Tannersville, N. Y. This work was undertaken for the protection of the New York City water supply in the Schoharie watershed, it purpose being to protect the sanitary quality of the water in Gooseberry Creek, a tributary of Schoharie Creek. The work, the contract for which was let on March 8, 1927, to the Paulsen Construction Corp., 21 East 40th St., New York City, included the construction of a collecting system, house connections, etc., and the building of disposal works of a daily capacity of 420,000 gal., comprising septic tanks, sludge beds, dosing chambers, sand filters and a chlorination plant.

The sand washing plant was installed at the disposal area and consisted in the main of a revolving drum with blank and cylindrical screen sections, three wash boxes, bins for plant product, etc. Run-of-bank sand was dumped on an elevated run-way and fed through a grizzly with bars spaced 5 in. apart to a bucket elevator which operated at a speed of 120 ft. per minute. The elevator discharged into a hopper which was supplied with water through three ¾-in. pipes and one 1½-in. pipe and delivered the sand to a revolving drum 48 in. in diameter which was divided into three sections. The first section, 6 ft. in length, was blank and carried blades similar to a concrete mixer; the second section was a screen section of ⅝-in. mesh and 8 ft. in length, enclosed in a ¼-in. sand jacket for the first 7 ft. of its length; and the third section comprised a screen section of 2-in. mesh, 6 ft. in length. The drum revolved at a rate of 13½ revolutions per minute.

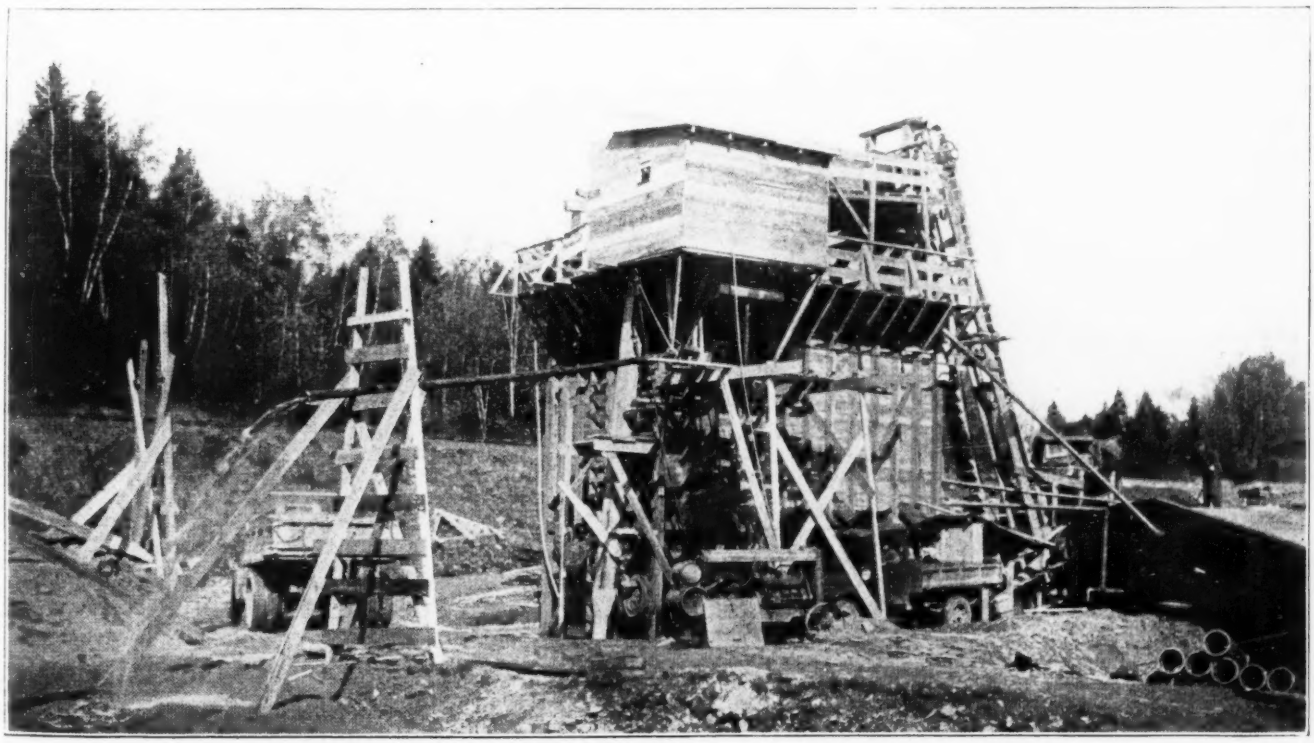
Water was applied both inside and outside the drum, an axial pipe, 2½ in. in diameter, supplying water to the inside of the blank section through ten equi-spaced ⅛-in. nozzles and to the ⅝-in. screen section through fourteen equi-spaced ¼-in. nozzles. Water was supplied to the outside of the sand-jacketed ⅝-in. screen section by a 2-in. pipe with thirteen ⅛-in. nozzles. The mixture of sand and water passing through the ¼-in. sand jacket fell into a hopper under the screen and was thence delivered by a chute to the first wash-box or scrubber. The gravel passing the ⅝-in. and 2-in. screens and the tailings were delivered by chutes to bins below.

The scrubber was a long narrow box with an inclined bottom in which a chain, with metal blades attached, pushed the sand up the incline and delivered it to the upper end of the second wash-box. The major portion of the conveying water and its fine sand content were wasted from the lower end of the scrubber.

The second wash-box was 10 ft. long, 2½ ft. wide and 1½ ft. deep at the upper end and 3 ft. 1 in. at the lower end, and water under pressure from three lines of 2½-in. perforated pipes located at the base of the box was forced up through the sand. The agitation produced by this forced water feed caused the heavier sand particles to travel by gravity along the bottom of the box and thence through a 3-in. discharge pipe to the third wash-box, while the lighter sand particles were carried in suspension and discharged with the washwater through a trough 7 ft. long by 8 in. wide, with a sloping bottom, located in the center of the wash-box at the lower end.

The third wash-box was made in the form of a truncated pyramid 2½ ft. deep and had top and bottom dimensions of 4 ft. 9 in. and 1 ft., respectively, the function of this box being to further reduce the percentage of fines in the sand.

From 600 to 800 gal. per minute of wash water were used during the operation of this plant. Up to Dec. 31, 1927, a total of 15,880 cu. yd. of run-of-bank sand was delivered to the washer and the resultant output was 6,400 cu. yd. of washed sand, 5,510 cu. yd. of gravel and 3,970 cu. yd. of waste and tailings.



Sand Washing Plant, Installed in Sludge Bed Area at the Disposal Works of Taylorsville Sewer System

Development of Regional Planning

An Outline of Progress in Canada

By J. CLARK KEITH
Chief Engineer, Essex Border Utitlities Commission, Windsor, Ont.

PROGRESSIVE communities have not been slow in realizing that they must put their affairs in order. There are 529 cities in 44 states of the United States which have city planning boards or commissions. In Ontario, insofar as I can ascertain, city planning commissions have been appointed or created in only eight communities—London, Kitchener, North Bay, Hamilton, Niagara Falls, Ottawa, Toronto and the Border Cities. This is not an indication that the need for them does not exist. On the contrary, the presence of such a body when actively functioning is an asset whose value in dollars and cents is not measurable to any growing community. Any city which is prepared to allow the future to care for itself tacitly admits that as a national asset it must be rated extremely low. Money spent on city planning, either for the correction of past errors or for sane future growth is not a speculative investment. No city body can be accused of speculating if it takes steps to provide for the welfare and health of its inhabitants. It should, on the other hand, be guilty of remissness if it loses opportunities for so doing, opportunities which may never recur.

City Planning a Misnomer.—City planning has come to be more or less of a misnomer. The essence of planning is to provide for expansion. The planner is more interested and has greater opportunities in the comparatively undeveloped areas in or adjacent to the city than in the well established sections. His field is as much outside the city boundaries as it is within them, and this is particularly true of metropolitan areas dominated by one great city.

It may be stated as a truism that the effect of the city upon its adjoining suburban area is no more pronounced and probably less so than that which the suburban areas may later have upon the city. From time to time, those areas would automatically become annexed to the city. This is not the trend of present day sentiment. Annexation as a means of providing civic amenities is giving way to regional government. There has been but one example in the twentieth century of a great city extending its boundaries to include numerous pre-existing municipalities—the creation of Greater Berlin in 1920. It required all the pressure of post-war necessity, plus a tradition of subordination to central control to bring this consolidation to pass. At that, it had to be accomplished by the devolution of extensive powers to divisions of the metropolis.

Prior to the advent of the motor car, suburban development clung closely to the city boundaries. Latterly, rapid transit enabled suburban communities to develop at greater distances from the city's center. The average commuting distance in Chicago today is stated to be fourteen miles. For a generation preceding the inter-urban electric, the steam railroads furnished the transportation and the suburbs were strung along these in a continuous chain. The electric lines and more recently, the automobile and motor bus, have enabled inter-spaces to develop, substantially suburban in character. Annexations have thus been retarded in recent years. The increasing necessity of thinking of and dealing with urban affairs in terms of metropolitan regions rather than as incorporated municipalities is now admitted without question.

Utilities and Regional Planning.—The planning of a regional area does not consist solely in laying down a network of major and minor highways, no matter how complete it may be in itself. It should make provision for such factors as water supply, sewage and sanitation, recreation facilities, parks and park systems, education, zoning, sanatoria and related health matters, rapid transit, aeronautics, cemeteries, harbor or water front development, etc.

If regional planning is to be undertaken, there does not seem to be any justification for the creation of innumerable commissions or boards to carry out the varied phases of regional development. Where two communities endeavor through a single agency to solve some problem which affects them jointly or in which they have a common interest they have touched some phase of regional planning. We have been prone to think of planning in terms of streets and highways, but surely health, water systems and sanitation are equally as important. How attractive would a model system of transportation be to any citizen if nothing else were provided? Each of us knows that if some minimum standard of water supply and sanitation could be insisted upon in the indiscriminate subdivision of land around every metropolis, that it could be hailed as a millenium in civic expansion.

What Regional Planning Accomplishes.—A regional planning disregards political boundaries and includes that large adjoining territory already a part, socially and economically, of the central city. Regional planning is not a program for spending vast sums of money. It seeks to insure the greatest return in the future for money wisely expended today. The outlying areas merely constitute a reservoir into which the surplus population from the center may overflow. The citizen of today, irrespective of his station in life, no longer wants to be a pioneer. He wants the same comforts in life for himself and family in his new surroundings that were provided in the old. He will expect some beneficent municipal government to provide him with water sanitation, recreation, education facilities, etc. How can these be secured unless there is a legally constituted body whose duty it is to see that every citizen has a chance to live decently and in comtfort?

In Canada the majority of water supply systems are municipally owned and newly developing areas are saved from competition and paralleling of lines where several companies might be seeking new business. Efficient sewage disposal is expensive and sometimes beyond the financial reach of small communities or sporadic developments. Economy, efficiency and health are served by the pooling of interests. The preservation of creek valleys as an adjunct to proper sanitary control or for park development purposes can be secured only through the adoption of a single plan for the district. The increasing densities of population require that schools under different jurisdictions be located with definite relation to each other and to a shifting school population. It is not a chance happening that places large centers of population where water transportation is available. A study of any portion of the world's map shows few large cities which have not direct access to the sea. Port problems are essentially regional in character and can be attacked efficiently only by regional action.

Regional planning as an adjunct to a city's future is not only highly desirable, but an absolute necessity. A safe guide in the proper limitation of the scope of a regional plan is to confine it to those functions which do not begin or end within a single municipal jurisdiction. It is founded upon the idea that it is economically more sound and equally in the interests of both that the larger city and its environs or satellite areas be planned as a unit. As yet we have few large cities in Canada but we will have them within the life time of many now concerned with present day problems. There is a limit

beyond which a city cannot grow to advantage or manage its affairs efficiently or economically. The larger the unit, the further government is removed from the people. Popular interest declines in direct proportion to this distance, up to the point where the appeal of national politics begins to take effect. Analysis of the various alternatives offered for the solution of the regional problem seems to lead to the conclusion that there should be a single authority for the region.

The Regional Plan.—There are two essentials to the preparation of a regional plan, first, effective legislative authority whereby the powers which each municipal entity might possess individually may be vested in a single authority; and, secondly, the wholehearted interest and untiring support of the citizens affected. Several municipalities may be faced with a definite problem requiring solution which can be effected only through special legislation. The first powers secured may provide for nothing beyond the immediate problem, but if it has been successfully executed, then the field for further activities is broadened immediately.

The first regional planning commission in the United States was created in Los Angeles as recently as 1923. Other cities where regional control is in effect or in contemplation include Philadelphia, Boston, New York, Pittsburgh, Chicago, San Francisco, Cleveland and Baltimore. Legislation for regional planning or for any particular phase of it cannot be standardized.

Metropolitan District Boards.—Insofar as I am aware there are only five commissions in Canada having jurisdiction in metropolitan areas. These are the Greater Vancouver Water District, the Vancouver Area District Joint Sewerage and Drainage Board, the Greater Winnipeg Water District Board, the Montreal Metropolitan Commission, which exists solely for the purpose of financial control, and the Essex Border Utlities Commission. There are other bodies, such as the Niagara Falls Park Commission, the Ottawa Improvement Commission, and the Quebec Streams Commission, which have been created by the state, but the first five enumerated have been formed at the request of interested municipalities having problems in common. All planning commissions in Ontario have control of subdivisions over a region extending three miles beyond the municipal limits in the case of towns and five miles from cities and in this sense only have the jurisdiction in regional areas.

The activities of three of the foregoing commissions are farily well defined and limited in their appelation to water supply and drainage. The Montreal Metropolitan Commission, made up of representatives of the local units involved, has the power to approve or disapprove the loans of any of the municipal entities concerned with the exception of Montreal itself. If, for example, the city of Outremont wishes to borrow money and the commission approves, the bonds of the Metropolitan district are issued and Outremont must levy taxes to recoup the commission for its assumption of the bonds. The success of this commission has sugested the extension of this principle to the general development of the whole area. Since the sixteen municipalities, of which Montreal is the center, have very real general interest which cannot very well be looked after without some form of coordination, it is probable that some measure will soon be granted by the Quebec Legislature.

Essex Border Utilities Commission.—The Essex Border Utilities Commission is the outstanding example in Canada of an organization created by the Legislature to deal with regional problems. Fronting on the Detroit River in Essex County, seven incorporated municipalities lie side by side without any apparent municipal division. These communities, with two adjacent townships, had common problems which could be solved efficiently and economically only through co-operation. The need of an organization to meet these conditions was recognized and the Essex Border Utilities Commission was formed in 1917. Constituted originally to deal with the related problems of water supply and sewage treatment, the commission has had its activities broadened to include the powers of a board of health, a parks board and a city planning board. The commission consists of twenty-one members, two from each of eight municipalities and five from the city of Windsor. In each case the mayor or reeve constitutes one representative from the community, while the others are elected for a period of three years. Thus the commission is entirely responsible to the electorate and its members serve without remuneration. Two members have been on the commission for eleven years and several others from five to ten years. The general overhead expense of the commission, such as office expense, clerical help, etc., is met by the various municipalities in proportion to the number of its commissioners on the board. All capital expenditures are met through debentures issued by the commission on the credit of and in proportion to the benefit which each municipality derives.

Since its inception, the commission has constructed intercepting sewers at a cost of $400,000, a filtration plant serving all municipalities at a cost of $1,140,000, a metropolitan general hospital costing $560,000, and is now engaged on a general plan covering waterfront development and further sewerage extensions which will cost from three to five milion dollars. These are tangible evidences of regional co-operative effort. but the most valuable activity of the commission has been in the preparation of a plan of main highways and boulevards to serve the future needs of the district. In less than two years time the highways through Essex County will carry heavier traffic than any other roadways in Canada. A definite plan was prepared almost six years ago, which was described and reproduced in the journal of the institute in June, 1924. With very minor alterations that plan has been the framework around which the newer sections have since been developed. All subdivision plans of the district must pass through the hands of a special committee of the commission before they can be registered. During the past eight years upwards of 300 plans have been dealt with, and at least 75 per cent of them were modified in some manner for the betterment of the district. The newer sections of the Essex Border District are not going to be faced with expensive corrective undertakings in the future. The area involved in planning studies covers about 125 square miles.

When an effort is being made to control and direct the development of a district, it is a source of irritation when something occurs which may tend to undo any part of the work that is being done. In the hope that the experience of other communities may be related at this gathering, reference is being made to the question of cemeteries. The relation between the city of the dead and the city of the living is an important problem in present-day planning. Like all other established physical elements of a city, the cemetery must be provided for and must be given that consideration which will permit it to function with the city and do as little harm as possible to it. The location of a cemetery has in many instances interfered with the best and most logical community growth. It is true that there is hardly a large city which has not witnessed the destruction of one or more of its cemeteries, yet once established it stands as a grim sentinel against the demands of urban growth. As a general proposition, a cemetery should be located away from industries and from the lines of common carriers, but should be in line with the city's residential growth but as far as possible from the existing housing. Neither should they be reached by, nor have their entrance from a highway bearing heavy traffic. In Ontario the location of a cemetery must first be approved by the municipality in which it lies and then by the Provincial Department of Health. Unfortunately the plan for a cemetery does not have to be registered and for this reason city planning boards have no control over them if they are outside the city limits but within the city's urban zone. Two cemeteries were recently located adjacent to Windsor for speculative sale on a highway which will be the main traffic artery of the district.

Acknowledgment.—The above paper was presented by Mr. Keith at the annual meeting of the Town Planning Institute of Canada.

Billing and Collecting Methods Used at Brainerd, Minn.

By W. D. McKAY

Secretary Water and Light Department, Brainerd, Minn.

IN the October issue of Municipal News and Water Works, I find an article by W. D. Stalker on "Time Saving Methods in Billing and Collecting."

Some six years ago or more I introduced a system which has worked very satisfactorily. It saves the expense of mailing bills to our customers, and in addition gives them the amount of their bills, as soon as meter is read.

The city has both water and light plants, and both meters are read at the same time, which is done monthly. There are about 5,000 meters, and two readers require about 21 days each month to read them. Our city is 100 per cent metered.

Blank No. 1 is used by the readers, and is filled out at once and left with the consumers. They have a read table to make it from, thus avoiding errors. The meter books are audited before bills, as shown in Blank No. 2 are made out from them in duplicate. These bills are filed in a cabinet in street and numerical order, so that customers can be handled very promptly, as it simply requires stamping date of payment. One of these bills is original, the other a duplicate, with perforation between. They are not separated until payment is made. The duplicate is used for our Consumers' Register. Frequently before we used this system, claims would be made that the consumer had paid the previous month, but when we had the original that was evidence enough to know, without any further reference, it had not been paid. These duplicates are a great means also of determining our delinquencies readily, and aid very materially in our trial balances.

Reading water meters monthly enables us to keep in close touch with their condition, as we own all meters.

ORIGINAL

Water & Light Dept. Nº 9107

CITY OF BRAINERD

Date of Reading.....8/22/28...192.

Present this at the Office of the Secretary when payment is made
Office Hours: 8 A. M. to 5 P. M., except Paydays,
when Office is open to 8 P. M.

Name ...J. Jones.....

Street and Number .....324 N 8thst.....

METER READING

CLASS	READINGS		CONSUMPTION	AMOUNT Dollars	Cts.
Light	Present	2647			
	Previous	2617	30	1	95
Water	Present	280000			
	Previous	276900	3100	1	55
Heat	Present	1552			
	Previous	1500	52	1	56
Power	Present	1000			
	Previous	260	740	10	40
Sprink'g	Present				
	Previous				
		Total		15	46
		Penalty			
		Total		1701	
		Adjustment			
		Total			
		Paid on Account			
		Balance			

NOTICE

Rules and Regulations for Customers

All rentals are due and payable at the office of the Secretary before 20th day of month following reading.

If rentals are not paid when due, a penalty of 10 per cent will be added and the city reserves the right to discontinue service without furher notice.

Parties moving into premises must report at once to the office of the Secretary, so that meter readings can be taken, and also ascertain whether previous month's rent has been paid, otherwise they will be held liable for said rent.

It will be appreciated if Office is notified of any leaks in streets or of any Arc Lights out of Commission.

Rules and regulations governing the system are printed and a copy will be furnished on application if you have none.

Blank No. 2

Water and Light Department

CITY OF BRAINERD

Telephone 66

Date of Reading _____ 192

Present this at the Office of the Secretary when payment is made.
Office Hours: 8 A. M. to 5 P. M. except
Paydays, when Office is open to 8 P. M.

Name _____

Street and Number _____

METER READINGS

Class	Readings	Consumption	Amount Dollars	Cts.
Light	Present Previous			
Water	Present Previous			
Heat	Present Previous			
Power	Present Previous			
Sprinkling	Present Previous			
	Total			

NOTICE

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Rules and regulations governing the system are printed and a copy will be furnished on application if you have none.

Blank No. 1

Schedule of Water Rates

All consumers up to 40,000 Gals, 50c per 1,000 Gals. From 40,000 Gals. up to 100,000 Gals. $20.00 per month minimum.
Over 100,000 up to 199,000 Gals. per month, 18c per 1,000 Gals.
Over 199,000 up to 299,000 Gals. per month, 14c per 1,000 Gals.
Over 299,000 up to 399,000 Gals. per month, 10c per 1,000 Gals.
Over 399,000 up to 700,000 Gals. per month, 8c per 1,000 Gals.
Minimum, 75 cents per month.

Sprinkling Rates

Sprinkling rates are governed by the April reading, and run continuously for five months. All used during this time in excess of April reading will be 10c per 1,000 Gals. Minimum of 1,500 Gals. per month for 75c. Sprinkling only applies beyond consumption of 1,500 Gals.

Electricity Rates

Light 6½ cents per K.W.H.
Power—First 500 K.W.H., 4 cents per K.W.H.
Power—Next 250 K.W.H., 3½ cents per K.W.H.
Power—All over 750 K.W.H., 3 cents per K.W.H.
Cooking—3 cents per K.W.H.
Minimum for Light, 75 cents per month.
Minimum for Cooking, $1.00 per month.

Minimum on Power

$1.00 per H.P or fraction thereof up to 5 H.P 25c per H.P or fraction for all over 5 H.P

Back of Blank No. 1

Administrative Problems of Sewerage

Interesting Discussion of an Important Subject

By P. F. HOPKINS
City Manager, Mason City, Ia.

THE fact that sewers are buried in the ground out of sight and sewage treatment plants are usually in more or less out-of-the-way locations tends to create a lack of public interest in them. There is, too, an innate dislike in the average person's mind for the whole subject of sewerage. This attitude on the part of the public undoubtedly is reflected in the official tendency to be slack in the administration and care of sewer systems and sewage treatment plants, and to do only that which is absolutely necessary for their operation. The householder is not concerned with the sewer in his street so long as it takes care of his wastes; he never sees it and it never bothers him, except in rare cases when it becomes clogged. On the other hand, he can see any defect in the surface of the street, and since its condition is important to him every day, he is not slow to complain when it needs attention. The sewage treatment plant is rarely visited by anyone but those responsible for its care, and even if it were visited, most people would expect to find a smelly, unsightly place and would not realize that such a condition might be due to improper care in operation.

Minimum Appropriations for Sewage Maintenance.—The net result of all of this is that nearly all administrators reduce the expense of sewage operations to a minimum and do just what is necessary to keep sewer systems open and treatment plants from getting too objectionable. Money saved in this way can readily be allocated where the public can see the results—and we never have sufficient funds to satisfy the demands for our citizens for street work and similar services.

I do not mean to give the impression that we deliberately set out to neglect our waste disposal utilities, but we are all human, and we are likely to take care of those things which cause the most complaints, to the possible neglect of those which are not bothering us.

Sewerage Maintenance in Smaller Cities.—It can be truthfully said that the limiting factor in all municipal activities is the amount of available funds. If that were not true it would be a simple matter to administer a city's affairs. But since it is true, we are always on the lookout for ways to hold down operating costs. Only in the larger cities are we likely to find a separate sewer department whose first duty is to see that the sewers are properly inspected and maintained. Every town has some organization for handling street work, and it is quite common practice to delegate to the street department the maintenance of the sewers. There is no real objection to this way of handling the work, and many reasons for such an arrangement, provided it is not permitted to degenerate into just a case of handling complaints and stoppages. The average workman does not relish sewer work and probably has little conception of the sewer layout or the real function of the system. It is best, therefore, to select a few men who are intelligent and conscientious workmen who can be relied upon to do the actual work under proper direction. Pay them a little extra because of the nature of the work. They will soon develop what might be called the "technique" of clearing stoppages. They should be equipped with good sewer rods, plenty of hose, and various devices and tools for meeting any condition. It is just a foolish waste of money to send men out to do any kind of work without the proper tools. It is best to assemble all of this equipment on a special truck or wagon, so that when they are needed no time will be lost hunting for them, and when the trouble is located the tools needed will be there. Unless a crew is properly equipped and intelligently directed, more time can be wasted and useless work done in clearing a clogged sewer than in any other housekeeping function of the city—and in the meantime maybe a block or two of basements are being flooded. And if the tax payer sees the gang aimlessly prodding away while his basement fills up, he is likely to judge the whole city administration by the way this particular job was handled; and it is surprising how long he will remember it.

Importance of Systematic Inspection.—No sewer system was ever constructed which did not at some time need attention. Systematic inspections will reveal tendencies to clog which can be quickly and easily cleared at this stage but which would mean a real job if the sewer becomes entirely clogged. After the system has been checked a few times, it will be apparent where the stoppages are most likely to occur. These places can be given a little more frequent attention. Dead ends, new sewers with few connections, garages, wash racks, tree roots—all are frequent contributors to sewer stoppages.

It doesn't matter just what the organization for sewer maintenance work is—each town or city may handle it differently—just so someone competent is made responsible for the work. The city engineer, where available, is the logical man to have control over the sewer system and disposal plant. His knowledge of hydraulics, of the layout of the sewer system, and of sewage treatment cannot be duplicated in the ordinary workman. He will analyze the causes of the troubles and will take the necessary steps to prevent a recurrence. He realizes the danger of allowing untrapped garage wastes and wash racks to go into the sewers; he knows that roof drains and cistern overflows will overload the sanitary sewers, and will be able to detect the prevalence of these in any section; he knows how to keep records and how to interpret them.

Value of a Spot Map.—Reports on sewer maintenance work need not be elaborate. Location of trouble, probable cause, any pertinent comments, and the cost of clearing, are sufficient. I am a believer in the value of visual records. A spot map showing the location of all sewer stoppages during the year may tell something that would not be apparent otherwise. You will be surprised at the number of repeaters. The removal of the cause will save you trouble and money.

Plant Operation Reports.—It is obvious that a plant operator must be a man of sufficient intelligence and dependability to take these records and, from them, to judge the plant's operation. In addition to the records that indicate the efficiency of the plant operations, the administrative official wants also such records as will tell him how much sewage goes through the plant, individual pump performance and current consumption where pumping is necessary, labor costs, frequency of sludge withdrawals, and the approximate quantities, when and why sewage is bypassed, when and why tanks foam and filters clog. He probably knows the daily water pumpage of the city which has a direct relation to sewage flow and will be able to detect any unusual relationship between this pumpage and sewage flow.

Periodic Supervision by Outside Engineers.—For the smaller towns which do not have technical advice available, it would be wise to arrange for periodic supervision by some competent engineer who can check up on operating conditions and advise your operator how to get results. This will not be beyond your financial resources and will save you money in the long run. The time required for such checkups will be ma-

terially shortened if reasonable records are available. Aside from the actual value of good operating records, there is a bit of practical psychology in requiring an operator to write down each day certain facts concerning his plant. He is not going to continually put down in writing statements of plant conditions which he knows should not exist. The chances are that he will take the necessary steps to correct them and will soon take pride in being able to truthfully record "all's well." On the other hand, if there is no daily log of the plant, it is quite easy for him to contend that the bad condition "just got that way lately."

Viewpoint of the Administrator.—Just a word or two in closing from the viewpoint of the administrator: He appreciates a neat appearing plant that is operating well—one that he can feel safe in showing to visitors without having to find some excuse for the conditions found. He appreciates, too, the employee who has the initiative to see the things that should be done without waiting to be told to do them; who comes with constructive suggestions for ways and means for bettering the operations for which he is responsible, and who can back up his requests for equipment or improvements with concrete facts and arguments that will justify the outlay required. The employee must, of course, realize that his requests are only a part of many requests from other departments, all calling for the expenditure of funds. It is the administrator's duty to weigh these requests as to their relative importance. Rarely can he grant them all; available funds again will limit his ability to provide.

It is standard practice in Iowa to special-assess the cost of street sewers to the benefited property. Some cities may have conditions which make the cost of sewers far beyond the $3 per foot which by statute may be assessed. This means that the deficiency must be made up by the city. The cost of sewage treatment plants is great. The millage permitted by law will not always finance this cost and amortize it within the probable useful life of the plant. How and where to legally find the necessary funds is not the least of the administrator's problems connected with the important and vital function of caring for a city's sewage.

I have tried thus briefly to suggest to you some phases of this problem which are always present but which you, in your capacity as operators may overlook, with the thought that you may be helped to see your work as only a part of the whole city's housekeeping; and that you may appreciate the administrator's viewpoint when he does not always provide the things which you feel so necessary.

Acknowledgment.—The foregoing paper was presented by Mr. Hopkins at the recent Sewage Disposal Short Course at Iowa State College, Ames, Ia.

Floral Clock a Park Feature

By GEORGE W. THOMPSON
General Manager, City of Westmount, Canada

The floral clock illustrated on this page is the only one of its kind in Canada, and there are very few in the world. There is one at Edinburgh, Scotland, one in England, one in Belgium and one in Switzerland.

The floral clock was suggested by the then mayor of Westmount, Mr. P. W. McLagan in 1926, and designed by Mr. John McCreath, head gardener of Westmount parks in collaboration with Mr. Geo. W. Thompson, who designed the electrical mechanism for operating the clock.

The flower bed for the clock is 21 ft. square and it is placed on a sloping elevation with a 2-ft. grade and a low open fence surrounds the clock.

Fifteen thousand plants have been used for the clock and setting, these being arranged in beautiful ornamental design. The minute hand is 8 ft. long and the hour hand 6 ft. long. Made of wood with tin sides, they are designed to hold hundreds of plants. Both arms have an outside border of Mesembryanthemums, with an attractive center setting of tall red Alternantheras and Echeverias, including a pivot effect by an Acalphya plant.

In the center of the bed is a 3-ft. ring of Dedum. A twisting rope of Santolina plants features the next circle, with two kinds of red Alternantheras on each side, plus an outer ring of Echeverias and red Alternantheras. In the third circle are the numerals of the clock; these are of red on a background of yellow Alternantheras. The yellow plants will be kept clipped while the red will be permitted to grow higher.

Just outside the numeral circle is a bordering ring of Alternantheras and Echeverias, while two more rings are added for decorative effect. On the outside border is a square framework consisting of several rows of Alternantheras, golden Privet and blue Lobelia. At each of the four corners an effective design of tropical flowers is arranged, including Dracaena, Pandanus, Centaurea and Lobelia. The elevation slopes away in a green lawn effect.

There is an inscription in flowers at the bottom of the clock, "Tempus Fugit." A spot light illuminates the clock at night.

New Municipal Airport for Cincinnati, O.—It is now hoped that the new municipal airport of Cincinnati, O., will be ready for dedication next year. The equipment will include a two-story administration building, which will house the offices of the municipal officials in charge of the field, and the offices of the Embry-Riddle Company, the present commercial operators at Lunken field, who are responsible in a large measure for the field's development. The administration building will also house waiting rooms for passengers. In addition there will be other buildings housing a pilots' room, a restaurant, hangars and other necessary quarters. Ample lighting facilities will be provided, which will include two-lamp changing flood lights of 10,000 watts each, a ceiling light, beacon lights, etc.

Floral Clock Located in Park in Canadian City

The Asphalt Paving Conference

Program of 7th Annual Meeting, New Orleans, December 3-7

An excellent program has been provided for the 7th annual asphalt paving conference which will be held Dec. 3-7 at the Roosevelt Hotel, New Orleans, La., under the auspices of The Asphalt Association, J. S. Helm, president, and The Association of Asphalt Paving Technologists, L. M. Law, president. The advance program follows:

MONDAY, DECEMBER 3rd
Registration
Lobby of Roosevelt Hotel

Special Notice

No day sessions of the asphalt paving conference have been scheduled for this day, but all registrants are cordially invited to attend a meeting in the Roosevelt Hotel at 10:30 o'clock A. M. and 2 o'clock P. M. of the South Central Division of the National Highway Traffic Association, A. H. Blanchard, president.

Informal Open House Reception
Special Features
Roosevelt Hotel
8:30 o'clock P. M.
Tip Top Inn, Twelfth Floor

TUESDAY, DECEMBER 4th
First Session, 9:30 o'clock A. M.
Tip Top Inn, Roosevelt Hotel
Chairman: J. S. Helm, President, The Asphalt Association

1. Address—J. S. Helm, President of The Asphalt Association.
2. Address—L. M. Law, President of the Association of Asphalt Paving Technologists.
3. Address—Hon. Huey P. Long, Governor of Louisiana.
4. Address—Hon. A. T. O'Keefe, Mayor of New Orleans.
5. Address—Hon. O. K. Allen, Chairman Louisiana State Highway Commission.
6. Address—Hon. John Klorer, Commissioner Public Property, New Orleans, La.
7. "The Eonomics of Asphalt Pavement Construction as Affected by Mechnical Equipment and Operation," by T. Warren Allen, Chief, Division of Management, U. S. Bureau of Public Roads.
8. "The Economics of Asphalt Pavement Construction as Affected by Materials and Control Methods," by H. M. Ulman, Assistant Engineer of Materials, Pennsylvania State Highway Department.

Afternoon Boat Trip on Mississippi River and New Orleans Harbor
New Orleans Refining Company, Host
Party will leave Roosevelt Hotel at 12:45 o'clock P. M. Luncheon will be served on boat.

Parallel Sessions 8:30 o'clock P. M.

I. Second Session, Asphalt Paving Conference
Room E. Mezzanine Floor, Roosevelt Hotel
Chairman to Be Announced

1. "The Airplane in American Commerce and Industry," by Col. Harry H. Blee, Chief Airport Section, Office of Aeronautics, U. S. Department of Commerce.
2. "Asphalt Construction and Treatment for Airport Runways," by A. H. Blanchard, Traffic Control and Airport Runway Consultant, Toledo, Ohio, Member National Aeronautic Society of U. S. A.
3. "Soil Investigation and Subgrade Treatments," by F. H. Eno, Research Professor, Highway Engineering, The Ohio State University; Chairman Advisory Board on Highway National Research Council.
4. "Waterproofing and Stablizing Subgrades with Asphalt Treatment," by C. A. Hogentogler, Highway Engineer, U. S. Bureau of Public Roads.
5. "The History of Black Base Pavements in Fresno County, California," by Chris P. Jensen, County Surveyor, Fresno County, California.
6. "Requirements for Asphalt Filler for Brick Pavements," by Harry J. Kirk, Director of Highways, State Highway Department, Columbus, Ohio.

Discussion—Bryson Vallas, City Engineer, New Orleans, La.

II. Association of Asphalt Paving Technologists
Business Meeting for Members
Room C. Messanine Floor, Roosevelt Hotel

WEDNESDAY, DECEMBER 5th
Third Session, 9:30 o'clock A. M. on Service Results from Use of Asphalt in State and Provincial Highway Construction
Tip Top Inn, Roosevelt Hotel
Chairman to Be Announced

1. "Service Results in Michigan," by V. R. Burton, Engineer of Research and Statistics, Michigan State Highway Department.
2. "Service Results in Georgia," by W. R. Neel, State Highway Engineer, Georgia.
3. "Service Results in Massachusetts," by V. L. Ostrander, Manager, Eastern Branch, The Asphalt Association.
4. "Service Results in Ontario," by R. M. Smith, Deputy Minister of Highways, Ontario Department of Highways.
5. "Service Results in North Carolina," by John D. Waldrop, Assistant Highway Engineer, North Carolina State Highway Commission.
6. "Service Results in Tennessee," by T. C. McEwen, Chief Engineer, J. E. Moreland, State Construction Engineer, and F. W. Webster, State Maintenance Engineer, Tennessee Dept. of Highways and Public Works.
7. "Service Results in Louisiana," by Major James M. Fourmy, State Highway Engineer, Louisiana.

Afternoon Entertainment Feature
Races at Jefferson Park
Standard Oil Company of Louisiana, Host
Races start at 2:15 o'clock P. M.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS
Technical Session, 8:30 o'clock P. M.
Gold Room, Mezzanine Floor, Roosevelt Hotel
Chairman: L. M. Law, President, Association of Asphalt Paving Technologists

a. Committee Reports.
b. Papers on Recent Research.

THURSDAY, DECEMBER 6th
Fourth Session, 9:30 o'clock A. M.
Tip Top Inn, Roosevelt Hotel
Chairman to Be Announced

1. "Opportunity and Obligation of the Petroleum Industry in Developing the Use of Cut-Back and Other Asphaltic Products for Surface Treatment and Low Cost Roads," by E. W. James, Chief Division of Design, U. S. Bureau of Public Roads.
2. "A Survey of Prevailing Practices in Connection with the Use of Cut-Back Asphalts and Other Surface Treating Materials," by Herbert Spencer, Standard Oil Company of New Jersey; S. A. Montgomery, Standard Oil Company of Indiana; J. N. Byrd, Mexican Petroleum Corporation.
3. "Methods and Trend of Practice in the Use of Soft Asphalt Cements for Surface Treatment," by Major Charles A. Browne, Chief Engi-

neer, Department of Hard Surface Roads, Orange County, Fla.

Discussion—A. M. Lewis, Arkansas Lime Products Company.

4. "Methods and Trend of Practice in the Use of Cut-Back Asphalts and Road Oils for Surface Treatment," by H. G. Nicholson, Engineer, Minnesota State Highway Department.

Discussion—Maj. E. R. Taylor, Chief Engineer, General Construction Co., Vancouver, British Columbia.

5. "The Economics of Conserving Our Investment in Existing Highways," by Professor H. J. Hughes, Dean of Harvard Engineering School.

Fifth Session, 2 o'clock P. M. on
Applied Paving Research
Tip Top Inn, Roosevelt Hotel
Held Under the Auspices of the Association of Asphalt Paving Technologists
Chairman: L. M. Law, President, Association of Asphalt Paving Technologists

1. "Research and Practical Experience," by A. W. Dow, Chemical Engineer, New York, N. Y.
2. "Practical Application of the Shear Test," by H. W. Skidmore, President, Chicago Paving Laboratory, Chicago, Illinois.
3. "Practical Application of the Stability Test," by Prevost Hubbard, Chemical Engineer, The Asphalt Association.
4. "Practical Value of Research as Applied to Paving Problems in Pittsburgh," by J. J. Paine, Director Pittsburgh Bureau of Tests.
5. "Value of Research to the Asphalt Paving Contractor," by Paul M. Wells, Laboratory, City and Contracting experience, Toledo, Ohio.

For the Ladies
Bridge and Luncheon
Orleans Club, 10:00 o'clock A. M.
Followed by Drive Through Old French Quarter
Mrs. George B. Penrose, Hostess

Evening Entertainment Feature
Masquerade Ball (Tentative)

FRIDAY, DECEMBER 7th
Golf Tournament for Men
The Metaire Club
Thos. H. Taylor, Chairman, Golf Committee
Tea for the Ladies, 4:00 P. M. at the club

Guest cards to golf clubs for the week will be provided for both ladies and gentlemen through the courtesy of the golf committee.

COMMITTEES

Engineering Committee — Chairman, Major James M. Fourmy, State Highway Engineer, Louisiana.

Arrangements Committee—Chairman, Hon. John Klorer, Commissioner of Public Property, New Orleans.

Entertainment—Hon. T. Semmes Walmsley, Commissioner of Public Finance, New Orleans.

Golf—Mr. Thos H. Taylor, New Orleans.

Publicity—Mr. Harold Wright, Aide to Mayor of New Orleans.

Reception and Welfare—Hon. Wm. T. Hall, Commissioner of Public Utilities, New Orleans.

Transportation—Mr. Walter F. Jahncke, Jahncke Service, New Orleans.

Registration—Mr. Sam Fowlkes, Manager New Orleans Convention Bureau.

Official Contact—Hon. Paul B. Habans, Commissioner of Public Safety, New Orleans.

Ladies' Committee—Chairman, Mrs. George B. Penrose, New Orleans.
Reception—Mrs. E. L. Jahncke.
Vieuv Carre—Mrs. H. C. Ehrenfels.
Bridge—Mrs. L. M. Law.
Transportation—Mrs. Paul F. Jahncke.

Race Track Party—Col. H. C. Ehrenfels for Standard Oil Co. of Louisiana.

Boat Trip—L. M. Law for New Orleans Refining Company.

How Tax Dollar Is Spent

The city of Rochester, N. Y., has imprinted on its tax bills the above interesting dial chart, showing the disposition made of each tax dollar collected. The total revenue expected from this year's assessments is expected to be $16,330,232, representing a tax rate of about $26 per thousand dollars of assessed valuation. It is sometimes said that charts like this are a help in tax collection, since the tax-payer is more willing to pay out his money when he can see where it is going. In this day of increasing municipal expenditures and consequently increasing taxes, anything that helps take the sting out of the tax bill is well worth trial.

Large Contract for Riveted Steel Pipe

The Witt-Humphrey Steel Co., with general offices and works at Greensburg, Pa., has been awarded a contract by the Bureau of Water of Philadelphia, Pa., for 7 miles of 8 ft. and 6 ft. diameter steel pipe. The Witt-Humphrey riveted steel pipe will be shipped from Greensburg in sections 38 ft. in length, each section weighing about 26,000 lb. This contract will require about 1,000 freight cars as the size of the pipe will only permit the loading of one pipe section to a car. The steel plates from which this pipe will be manufactured are 9/16 in. thick and the total plate tonnage required for this contract will be approximately 20,000,000 lb. In all probability the plates will be rolled in the Pittsburgh district. The pipe will be protected against corrosion by being dipped vertically in a bath of special refined asphaltum and inasmuch as the Witt-Humphrey Steel Company had installed in their new pipe works at Greensburg one of the largest electrically heated dipping tanks in the country, they were in a position to fulfill the specified requirements for the dipping of such large pipe. Shipments of this pipe will begin about Jan. 1, 1929. The above company is now building at their works in Greensburg a pipe line for the city of Detroit, also 8 ft. in diameter, which contract will be completed in December.

Municipal Airports. — According to annual report of the U. S. Secretary of Commerce, made public on Nov. 30, there are 352 municipal airports in this country, with an additional 890 under construction or proposed. Department of Commerce intermediate fields now number 256. Military and naval airports and marked auxiliary fields bring the total number of flying fields to 1,356.

Dial Chart on Rochester Tax Bills

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

To Our Readers

Distributor News is now one month old having appeared in each of our monthly publications. But, this is a short time in which to become acquainted with 73,000 readers, the number to whom The Gillette Construction Group of magazines goes. Of course, not all of this large number are directly interested in the distributor section, but we hope all of our readers will look it over, for there is bound to be an item from time to time of interest to every one. It is a business asset to know with whom you are competing and Distributor News is the place to become personally acquainted with your friends and competitors.

Up-to-date our distributor friends from the far west seem to be a little ahead of other sections in number of stories telling of their organizations and growth. Distributor News congratulates the Pacific Coast on the business enterprise described in the stories coming our way. We should like to hear from other sections of the country with stories to match those of the west. Send in pictures of your warehouses and little sketches of your sales managers, with photographs if you care to present them.

Take advantage of this department, which is at your service. Create in it such a lively reader interest that it, too, will become a warehouse—not for equipment—but for information of interest to every equipment manufacturer and distributor. Send in your items of personal news, stories of your business growth, questions you would like to have answered or letters which you believe would be of interest to others in your field. Address all communications to Editor, Distributor News, Gillette Publishing Company, 221 East 20th St., Chicago.

Hunter Machinery Company Reports a $1,000,000 Year in Michigan

THE Hunter Machinery Company, large distributors of construction equipment, incorporated under the laws of both Michigan and Wisconsin, announce 1928 to be one of the most successful years in their history.

The Michigan company's new plant at Detroit met with such immediate success that the sales volume for the first year is reported as considerably over $1,000,000. Following the successful results of the opening of the Grand Rapids office in 1926, the capital of the Michigan corporation was increased to a fully paid up capital of $250,000, in order to accommodate the growing business.

Mr. M. R. Hunter, president of the company, reports that the Detroit plant has been doubled and additional ground purchased to the south of the main building. The display room has a 100-ft. frontage on Waterman Ave., and is two stories high, in order to take care of Northwest cranes, Rex pavers and other equipment carried in stock. The plant includes a large modern parts room, and at the rear of the building there is a two-story shop of fireproof construction. Both buildings are of brick, concrete and steel. Mr. Hunter states that additional ground has been secured at Grand Rapids, doubling the holdings of that plant, and an additional building is under construction there.

Announcement is made that Mr. Alex. G. C. Duncan has joined the sales force of the Detroit plant. Mr. Duncan for the past twelve years has been engaged in the contracting business in Philadelphia, specializing in paving.

The officers of the Michigan corporation of the Hunter Machinery Company are: Morton R. Hunter, president; B. E. Uebele, vice-president and treasurer; T. G. Abrams, vice-president in charge of sales; R. A. Arndt, assistant treasurer, and M. P. Allen, secretary.

The Wisconsin corporation announces many additions and improvements in the plant at Milwaukee. It is stated that that the 1928 sales for the Wisconsin company will exceed $1,000,000. The sales record of the Hunter Machinery Company places it in the front ranks as manufacturers' distributors, and equipment from the following plants is handled:

Atlas Motor Mixers.
Bates Valve Bag Co.
Blaw Knox Company.
Chain Belt Company.
Dure Pumps and Saw Rigs.
Cleveland Wheelbarrow & Mfg. Co.
Northwest Engineering Co.
Pulsometer Steam Pump Co.
Reynolds Portable Furnace Co.
Roos-Meyer Hecht Co.
Rowe Mfg. Company.
Sasgen Derrick Co.
Clyde Iron Works Sales Co.
Conneaut Shovel Company.
C. D. Edwards Mfg. Co.
A. W. French & Co.
Homelite Corporation.
A. Leschen Sons Rope Co.
C. A. Londelius & Co.
M. & M. Wire Clamp Co.
Mulconroy Company.
Sauerman Bros., Inc.
Sullivan Machinery Co.
Syntron Company.
Templeton, Kenly & Co.
Toledo Pressed Steel Co.
Western Wheeled Scraper Co.

J. A. Manley to Direct Fairbanks-Morse Sales

John A. Manley, who has been Manager of Sales Development for Fairbanks-Morse & Company of Chicago, for the past three years, has been elected vice-president in charge of sales, according to a recent announcement of the Board of Directors. Mr. Manley, whose career has been one of rapid advancement in the business world, was formerly Manager of Accounts for the nationally known advertising agency of Henri, Hurst & McDonald, also of Chicago. In his connection with advertising work Mr. Manley made a detailed study of the problems of industrial business development and it was the result of this work that brought him into the Fairbanks-Morse organization.

J. A. Manley, Vice-President, Fairbanks-Morse & Co.

In 1911 he was graduated from Northwestern University and entered the sales department of the Republic Tire & Rubber Co. After four years with this organization he joined the advertising staff of one of the Chicago newspapers. Later he was connected with Hart, Schaffner & Marx, studying the problems of the retail merchant, and after two years in this connection went with Henri, Hurst & McDonald.

In its varied line of products which include Diesel engines, pumps, motors, scales, railway equipment, small light plants and automatic water plants and similar items, Fairbanks-Morse & Company has an interesting sales problem. That the problem is being effectively handled under the present management is shown by the steadily increasing volume of business flowing into the Fairbanks-Morse organization.

Manufacturers and Distributors Day at the Road Show

The attention of manufacturers and distributors is called to the importance of being in Cleveland, Jan. 12. The Road Show, which is to formally open on Monday, Jan. 14, has set aside Saturday, Jan. 12, as a day to be given over to distributors and manufacturers. This will afford an opportunity for contact between manufacturers, distributors and representatives previous to the rush occasioned by the attendance of contractors and engineers after the formal opening.

A joint meeting of distributors and manufacturers will be held late in the afternoon of Jan. 12, at which there will be a short program and matters of interest will be discussed. This day, devoted to the interests of distributors and manufacturers, is an innovation for the Road Show, and the directors of the Highway Industries Association have issued a notice urging a good attendance. The announcement further states that all exhibits should be in place by the morning of the 12th.

W. A. Riddell Company Opens Branch at Little Rock, Arkansas

On November first a branch of the W. A. Riddell Company was established at North Little Rock, Ark. Mr. O. E. Tapley has been appointed branch manager. Mr. Tapley was formerly connected with the Arkansas State Highway Department, and is well known among road men, contractors and highway officials throughout the state.

The W. A. Riddell Company manufacture the well known WARCO line of road machinery, and a full line of their products will be carried by the North Little Rock branch. Graders, road rollers, wheeled scoops, full and semi-crawlers, and crawlerized tractors will will be delivered direct from the warehouse at North Little Rock. Orders for parts will also be filled by the branch. This will be a distinct advantage to the users of WARCO when in urgent need of repair parts.

The Riddell Company are pioneer manufacturers of one-man graders and announce that an extensive exhibit will be displayed at the Road Show in Cleveland, Jan. 14-18.

Truck-Tractor Equipment Co. Takes Over More Territory

The Truck-Tractor Equipment Co., 460 Neilston St., Columbus, O., well known tractor and equipment distributors, have recently enlarged their territory considerably and increased their sales activities.

Testing Out Model DH Trackson McCormick-Deering. From Left to Right: F. M. Duffy, General Manager; L. E. Andrews, Trackson Representative; Elmer E. Schatz, President Truck-Tractor Co.; R. K. Gilson, Sales Manager

In addition to the central Ohio territory, these distributors are now also covering the Cincinnati district, almost all of West Virginia, and parts of Kentucky, Maryland and Indiana. They have recently arranged with the International Harvester Co. for the distribution of McCormick-Deering Industrial tractors in these territories, and with the Trackson Company for the handling of Trackson full-crawlers, shovels, loaders, cranes, etc., which are adapted to combination with the McCormick-Deering.

The picture shows officials of the Truck-Tractor Equipment Co. testing out and admiring the Model DH Trackson McCormick-Deering unit, which has had a good sale in their territory.

It is the policy of these distributors not to sell competing lines; instead they concentrate on the sale of a few lines which have proved most suitable for their territory. The contracting, highway, and industrial fields are their most important sales outlets, and for several years they have done a good business with the Ohio and West Virginia State Highway Departments.

Timken Roller Bearing Co. Announces Expansion Program

In order to meet the ever-increasing demands for the products of the Timken Roller Bearing Company an immediate expansion of production facilities was called for. The program is now under way to provide equipment necessary to raise the present output of the company from 175,000 bearings to over 200,000 per day. During the current year an expenditure of about $6,000,000 was required to meet the needs, which covers additions to both steel mill and bearing factory.

Steel producing facilities now in operation have increased the capacity of the plant to 30,000 tons per month of high grade open hearth and electric alloy steels. The new facilities include the purchase of the plant and equipment of the Weldless Tube Company at Wooster, O., as well as additions to the mill at Canton.

Work is now under way on various extensions to the bearing factory for the machine equipment needed to take care of the increase in the production schedule.

A New Plant at South Charleston, W. Va.

The Prest-O-Lite Company has established a new acetylene plant at East Ave. and Short St., South Charleston, production at this plant starting the latter part of October. This brings the total number of Prest-O-Lite plants throughout the country up to 35. Dissolved acetylene for welding and cutting will be supplied to local industry from this point. The plant is in charge of J. J. Robinson and the district superintendent, Mr. S. P. Murphy, whose headquarters are in Cincinnati.

Notes on the Trade

Mr. H. A. Barker, a member of the Export Division of The Dorr Company, sailed for South America on October 13th for an eight months' visit in connection with his company's sanitary and metallurgical interests in that continent.

Mr. A. T. Hastings, who has for several years been manager of the Los Angeles office of the Dorr Company, sailed for Europe on October 20th to join the Dorr Company, Ltd., London. Mr. A. M. Kivari succeeds Mr. Hastings as manager of the Los Angeles office. The New York office of The Dorr Company, Engineers, is located at 247 Park Ave., New York City.

Mr. Harold C. Osman, secretary of the Nugent Steel Castings Company, Chicago, has been appointed Works Manager. Mr. Osman formerly was in charge of sales for that company.

Crashing Through

THIS title is not modern slang. It describes exactly what a 12-ton gasoline roller did to an improvised stone wall erected across Bay Shore Highway, when it was opened to traffic between the cities of San Francisco, San Mateo and Burlingame, Cal.

The opening of this new highway, constructed by the California Highway Department to provide a third outlet for vehicular traffic from San Francisco on the south, was accorded a formal celebration early in October. The improvised stone wall across the highway was wonderfully realistic. At the command of the city attorney of San Mateo, J. E. McCurdy, "Let the barrier be broken," the big steam roller snorted and puffed its way forward, while cheers went up from a thousand throats, and the new and important link of the Bay Shore Highway was opened. Following the crash of the steam roller, a troupe of young girl dancers strewed a pathway of flowers and a long line of automobiles sped down the highway.

The 12-ton gasoline roller used to break the barrier was the one which had been used by Contractor C. W. Wood in the construction work. It was piloted by Mayor Frank Beer of San Mateo. Riding with him were R. L. Stone, acting mayor of Burlingame, and W. F. Benedict, assistant manager of the San Francisco Chamber of Commerce, representing Mayor Rolph, who was late in arriving from San Francisco, because of having to welcome the Japanese Ambassador. Mayor Rolph arrived in time to offer his congratulations to the peninsular cities on the opening of the highway, which promises much for the future prospects of the two counties so united.

The opening of this highway was carried out in dramatic form, and the central actor was the gasoline roller, which had first built the road, and then led the procession over it. The Edward R. Bacon Company of San Francisco was the equipment distributor who furnished this piece of machinery.

12-Ton Gasoline Roller Going Through Wall to Open New California Highway

Millers Falls Line of Portable Electric Tools Now Handled by Ryerson

Joseph T. Ryerson & Sons, Inc., with plants at Chicago, Milwaukee, St. Louis, Cleveland, Cincinnati, Boston, Buffalo and New York, have taken on the Millers Falls line of portable electric tools. This is a fortunate arrangement for the Millers Falls Company, of Millers Falls, Mass., as the Ryerson company have handled high grade electric tools for years, and their judgment and sales ability is particularly good in this field.

Larger Quarters

Cox & Silver, Inc., Advertising Agency, formerly located in the American Trust Bldg., have recently taken larger space in the new Watts Bldg., Birmingham. Among other accounts handled by this firm is the McWane Cast Iron Pipe Company of Birmingham.

The Clinch-Mitchell Construction Co., Successors to Flick Construction Co.

The Clinch-Mitchell Construction Company, 208 South La Salle St., Chicago, is the name of the new corporation organized to succeed the Flick Construction Company (a Delaware corporation) at the same address. This company, engaged in general railroad contracting, will have the same policy and the same officers as the former organization. The officers are: President, Mr. Edward H. Taylor; vice-president, Mr. Scott Mitchell; treasurer, Mr. Duncan L. Clinch, and secretary, Mr. Karl A. Milar.

Trackson Company Appoints New Distributors

The Trackson Company, Milwaukee, Wis., manufacturers of Trackson Full-Crawlers, Loaders, Shovels, Cranes, etc., announce the appointment of the following distributors: Brinker Supply Co., 905 Clark Bldg., Pittsburgh, Pa., and R. L. Stockard & Son, 2302 Charlotte Ave., Nashville, Tenn.

Both of these companies are well known tractor and equipment distributors handling the McCormick-Deering Industrial Tractor, Trackson equipment for the McCormick-Deering, and other related lines. They will also carry a complete stock of Trackson repair and replacement parts, and will be able to give prompt service on all orders.

New Appointments

Foster Chemical Equipment Company, 1124 Chemical Bldg., St. Louis, is the representative in that territory for the Peerless Pump Company, with factories in Los Angeles, Calif., and Massillon, O.

The Pennsylvania Pump & Compressor Company of Easton, Pa., announce the appointment of Mr. J. F. Rogers, 726 Oliver Bldg., Pittsburgh, as representative in that territory.

Mr. Gustavo Preston, 113 Broad St., Boston, Mass., has been appointed to represent the Pennsylvania Pump & Compressor Company.

Distributor Notes

Mr. Staats Abrams, distributor for Sullivan Portable Compressors and equipment, has moved his Newark office to 218 Cleveland St., Orange, N. J.

The Monongahela Supply Company has been appointed by the Sullivan Machinery Company as distributor for their products at Morgantown, W. Va. Mr. R. R. Harrison is in charge.

New and Improved Equipment for the Municipal Field

WATCH THESE TRADE ANNOUNCEMENTS FOR THE LATEST EQUIPMENT AND METHODS

The following trade publications, of interest to municipal officials, contractors and engineers, have been received. By writing the manufacturers named and mentioning this magazine, copies may be secured.

Trade Publications

Snow Removal Equipment.—The Monarch Tractors Division of the Allis-Chalmers Manufacturing Company has just issued a very attractive little booklet on Monarch Tractors for the removal of snow. The story of how to free the roads of snow in a quick and economical way is presented in this booklet. Specifications are given of Tractors "50" and "75." The Monarch Tractors Corporation of Springfield, Ill., is a subsidiary of Allis-Chalmers Manufacturing Company which is located at Milwaukee.

Playground and Water Apparatus.—Catalog No. 20 has been issued by the Ever Wear Manufacturing Company, Springfield, O. This is a 48-page, indexed, illustrated booklet, giving detailed information of playground and swimming pool equipment. 161 different models are shown, each one of which carries the company's guarantee of satisfaction. The catalog is very artistic in appearance.

Automatic Pumping.—A method used to make suction lift centrifugal pumps automatic, is treated in Bulletin B-H 850 just issued by Barrett, Haentjens & Co., Hazleton, Pa. The unit described in this booklet is of general interest. The subject is so clearly presented that it can be easily understood by the average mechanic, electrician or even a non-technical reader. The method of starting and stopping of the centrifugal pump by a float switch, push button, pressure regulator or time switch is plainly shown. The way in which the pump is primed is explained, as well as devices to protect the pump and electrical equipment against damage due to loss of prime, suction air leaks, a broken discharge pipe, and many other adverse operating conditions. A request addressed to Mr. W. A. Cather, Sales Manager of Barrett, Haentjens & Company, Hazleton, Pa., will bring you a copy of this bulletin. In writing ask for Bulletin B-H 850, mentioning the name of this magazine.

Clarifiers.—The Dorr Company, Engineers, 247 Park Ave., New York City, issue a sanitary engineering bulletin describing the applications and advantages of Dorr equipment in water treatment work. This company has branches in the principal cities of this country as well as in Europe, Africa and Australia. Write to the local office of this company or to Mr. F. H. Jones of the New York office for a copy of this bulletin. It would be appreciated if you would mention the name of our magazine when writing.

Chemicals.—This is the title of a very handsome catalog issued by the Kalbfleisch Corporation, 200 5th Ave., New York. Printed on heavy enamel paper, buff bordered, with display type in blue, and heavy blue cover, its eighty-four pages make a strong appeal for the reader's interest. This corporation has a background covering a period of a century of identification with the chemical industry of the United States. The first part of the booklet is devoted to the sources, manufacture and uses of chemicals, and a long list of chemicals manufactured by this company; industrial chemicals—chemicals for paper industry and miscellaneous chemicals. The tables at the back of the book give atomic weights, corrections for temperature, and many other tables to serve the chemical user.

Caterpillar Tractors.—Issue No. 32 of The Caterpillar Magazine presents concrete stories and illustrations of the almost endless uses to which the Caterpillar can be put. Particular attention is called to the service of this piece of equipment for airport building, and the fact that "every dropping off" place may soon become a "dropping down place" necessitating the building and maintaining of airports. Write to Mr. W. H. Gardner, San Leandro, Calif., for further information and a copy of the magazine, mentioning our magazine.

Efflorescence on Masonry.—The American Face Brick Association has prepared a brochure presenting the outstanding facts about the occurrence of afflorescence on masonry walls and how to avoid it. Two investigations were conducted for the association at the National Bureau of Standards, U. S. Department of Commerce, Washington. The investigations reported were made by L. A. Palmer, Research Associate, under George K. Burgess, Director of the Bureau of Standards, and the Research Committee of the American Face Brick Association, composed of F. W. Butterworth, Wm. C. Koch and L. B. Rainey. American Face Brick Association, 130 North Wells St., Chicago, will furnish this book on request for "Wet Walls and Efflorescence." The booklet contains 55 illustrations to show the points discussed.

Wrought Iron Pipe Bulletin No. 10 from the Cohoes Rolling Mill Company, Cohoes, N. Y., discusses the properties of Cohoes genuine wrought iron pipe; rust resistance, toughness and strength; bending qualities, etc. This company has branch offices in the principal cities.

Porous Concrete Well.—There are many outstanding features for this type of well, which is discussed in a folder issued by F. Thorpe, 1932 Illinois Ave., East St. Louis, Ill. This folder gives a list of references where this type of well has been installed. For particulars concerning this type of well write to Mr. Thorpe, mentioning Municipal News and Water Works.

Pipe Cutter.—This piece of equipment is made in two sizes for all types of pipe. It is manufactured by Ellis & Ford Mfg. Co., 18 Piquette Ave., Detroit, Mich., and particulars are given in a circular, which will be sent upon request by the manufacturer.

Hydrants and Valves.—The Columbian Iron Works will send descriptive literature upon request concerning fire hydrants, gate valves, valve boxes, hydrant extension sections and other items of water works equipment. This company is located at Chattanooga, Tenn. In writing to Mr. W. A. Mattice of this company for literature, kindly mention this magazine.

Water Meter Repairs.—Reading Meter Repair Company, Inc., Reading, Pa., will be pleased to send information and prices concerning repairing or testing of water meters. This company carries meter housings, gate valve housings, Reading curb boxes and other hydraulic supplies and equipment. When writing to this company for information, refer to Munipical News and Water Works. Mr. Emil Neubling will care for your requests addressed to him, care of the manufacturer.

Centrifugal Pumps.—Write to De-Laval Steam Turbine Company, Trenton, N. J., for book W-67, which gives detailed information on geared steam turbine driven pumps, electric motor driven pumps, or internal combustion engine driven pumps. In writing to Mr. H. B. Watson of the company for this bulletin, kindly mention our publication.

Flap Gates.—Brown & Brown, Inc., Lima, O., will send you upon request descriptive literature concerning their flap gates for every purpose. In requesting this information from Mr. C. S. Brown, we would appreciate it if you would mention Municipal News and Water Works.

Water Main Cleaning.—This is the subject treated in a booklet issued by the National Water Main Cleaning Co., 32 Church St., New York City. Mr. C. F. Inglee, at the above address, will send this booklet on request to anyone interested in this problem. Will you use the name of our magazine, if writing?

Cast Iron Pipe.—Write to the McWane Cast Iron Pipe Company at Birmingham, Ala., or the Pacific State Cast Iron Pipe Co. at Provo, Utah, for illustrated literature on this product, which is manufactured by a foundry practice of merit proven by centuries of use. If you mention this magazine, Mr. Arthur K. Akers will be pleased to send you a copy.

Deep Well Pumps.—The United Iron Works, Inc. of Springfield, Mo., manufacturers of "Pomona" double stroke deep well power pumps, offer without obligation methods for economically solving pumping problems. Write for data, mentioning this magazine.

Clean Out Augers.—Mueller Co. of Decatur, Ill., with branches in New York, Dallas, San Francisco and Los Angeles, will send you price list and complete details on request regarding time and labor saving devices for water works men. Equipment for cleaning and repairing old service boxes; repair lids to fit old and new type service boxes are described. Address Mr. C. N. Wagenseller, who will be pleased to furnish this information. Kindly mention Municipal News and Water Works.

Chlorine.—The Mathieson-Alkali Works, Inc., 250 Park Ave., New York City, offer the services of their company in furnishing valuable technical information regarding the use of chlorine for health protection; sterilizing water supplies; disinfecting sewage and destroying noxious sewage gases, etc. Write for particulars; address Mr. J. R. Schmertz.

Dual Control Trencher.—Bulletin 20-X gives detailed information regarding the P. & H. Trencher manufactured by the Harnischfeger Corporation, 3902 National Ave., Milwaukee, Wis. One of the important features of this equipment is the fact that the operator can work from either side. This company has branches in all the principal cities. Write to Mr. H. S. Strouse for copy of this bulletin, mentioning this publication.

Mechanical Surface Aeration.—An effective means of producing activated sludge, the economical method of attaining a high degree of nitrification, is described fully in E-5-28, issued by the Simplex Ejector and Aerator Company, 2528 West Madison St., Chicago. Mr. William Buckley will be pleased to send you a copy of this bulletin. Kindly mention this magazine when writing.

Snow Removal Machinery.—A very attractive red, white and blue broadside has just been received from the Cleveland Tractor Company, Cleveland, O., making the problems of heavy snows seem simple when met with this snow removal machinery. Two Cletrac 40's are part of the equipment chosen for the Byrd South Pole Expedition. Mr. H. E. Orr is advertising manager of this company.

Vertical Boom Ditcher.—Barber-Greene & Company, 505 West Park Ave., Aurora, Ill., are featuring their vertical boom ditcher in a booklet, "Ditching, Snapshots and Records," a copy of which will be sent on request addressed to Mr. J. H. Gregory. It would be appreciated if you would mention this publication.

Chlorinator.—Bulletin W-20, issued by the Paradon Manufacturing Company of Arlington, N. J., describes in detail chlorination by the dry feed method. Address Mr. R. V. Donnelly, care of the manufacturer, for booklet on this method of chlorination. Kindly mention Municipal News and Water Works.

Dragline.—Write to Koehring Company at Milwaukee, Wis., or to any of their branches in the principal cities, for Dragline Bulletin DL9. The ease of control and speed in functioning are important features of this heavy duty Koehring equipment. Mr. O. C. Dahlman will furnish bulletin or other information on request. When writing please mention this magazine.

Cast Iron Pipe.—Address Mr. Thos. F. Wolfe, Peoples Gas Building, Chicago, Ill., for authoritative data on any subject pertaining to the use of pipe. Mr. Wolfe is the engineer of the Cast Iron Pipe Research Association, and is ready to render assistance to pipe users at all times. Refer to Municipal News and Water Works if writing for information.

Pipe-Seal.—If interested in jointing compound, write to The Ruberoid Company, New York City, for their folder regarding Ru-Ber-Oid Pipe-Seal. Address Dept. P-43, 95 Madison Ave., New York City, mentioning this magazine.

Automatic Air Lift.—The Sullivan Machinery Company, 130 North Michigan Ave., Chicago, Ill., has a handbook on their automatic air lift, and special automatic control information of particular interest to water works superintendents. A letter to the Sullivan Machinery Company, attention of Mr. S. B. King, will bring you this information. In writing mention Municipal News and Water Works.

Sewage Ejectors.—Yeomans Brothers Company have a complete catalog on Building or Municipal Equipment. This catalog features the Yeomans-Shone Sewage Ejectors and Duplex Bilge Pumps. Write to this company at their Chicago address, 1423 Dayton St., Chicago, for this catalog. Mr. V. S. Weiler of the company will be pleased to furnish you with this catalog if you mention this magazine.

Meter Boxes.—The Ford Meter Box Company of Wabash, Ind., have a special bulletin on the Ford Type S Meter Boxes for "warmer climates." Meters can be set or removed in an instant in this equipment. Mr. John Ford of the company will send this special bulletin upon request, and the use of the name of our magazine when writing would be appreciated.

Centrifugal Pumps.—In order to be of assistance to users in choosing the right pump for their needs, Bulletin 1632-I has been issued by Allis-Chalmers, Milwaukee, Wis. Types for steam turbine drive, motor drive or gasoline engine drive are described to best fit the purposes of installation. Write to Mr. H. G. Hoffman for copy of this bulletin, mentioning Municipal News and Water Works.

Meters.—The Buffalo Meter Company, 2909 Main St., Buffalo, New York, offer a 34-page catalog without obligation giving detailed information concerning Niagara and American meters. A postal card addressed to Mr. C. K. Bassett at the address of the company will bring this catalog to you, free of charge. When writing kindly mention Municipal News and Water Works.

Industrial Cars and Equipment.—Catalog No. 100, issued by the Koppel Industrial Car & Equipment Co., Koppel, Pa., is a reference book and guide for use in the construction of good roads, treating of modern and efficient hauling systems. This catalog is published for the use of highway engineers, state, county and township authorities and road contractors. The booklet contains much helpful data, cross sectional drawings, and specifications and illustrations of equipment. There is a glossary of road terms, published at the recommendation of the Society of Civil Engineers. The catalog contains 50 pages, printed on heavy enamel paper and is firmly bound. A convenient and useful book. In addition to the larger catalog, bulletins No. 43 and No. 51 have been issued by the same company, featuring batch boxes, portable track, koppel cars and other equipment.

Meter Boxes.—Catalog No. 24, issued by the H. W. Clark Company, Mattoon, Ill., will bring you information on how to protect water meters from frost, traffic and tampering. Specifications to accommodate all types. Use the name of our magazine when writing to Mr. Donald Clark of the company for this catalog.

Deep Well Turbines.—The American Well Works of Aurora, Ill., offer without obligation a special engineering bulletin on all types of American Deep Well Turbines. Simply address Mr. H. V. Spiller and booklet will be sent. Kindly mention this magazine.

Engineers' Instruments.—A very complete catalog containing 134 pages is available concerning instruments, equipment and supplies for engineers, draftsmen and architects. It is issued by the A. S. Aloe Company of 1819 Olive St., St. Louis, Mo. Every item is illustrated and price given. The catalog is well indexed and should be very helpful to the engineering profession in renewing or completing their equipment.

New Drive for Sand Pumps

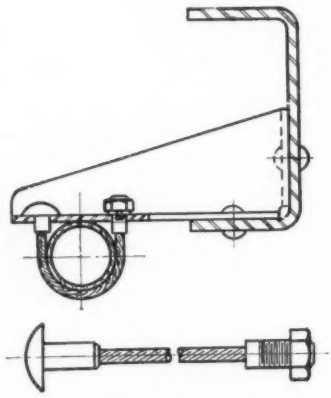
The Climax Engineering Company, of Clinton, Iowa, offers a unique drive for sand pumps where it is not advisable to direct connect the engine to the pump.

One installation has been made using Climax Model R4U, 6 in. x 7 in., 85 H. P. engine, connected to a 6 in. sand pump with a special drive. This drive is taken from the engine by a Twin Disc Inclosed Clutch and through a Texrope Drive which furnishes the necessary speed reductions between the engine and the pump, permitting the engine to operate at 950 RPM and the pump at 625 RPM. Provision is also made for driving a service or priming pump from the front end of the engine.

In a recent test the capacity of the unit delivered much in excess of 1,000 gal. of clear water per minute, or more than 30 cu. yd. of solids, to a maximum height of 60 ft.

This oufit has proved to be a very popular type for contractors and has an attractive field for installation on barrel type dredges to pump sand and gravel from the bottom of a river or lake to a sorting or screening bin on the shore or at the top of a hill.

Its easy portability and extreme light weight have appealed immensely to the contractor or operator engaged in this business.



New Drive for Sand Pumps Announced by Climax Engineering

The engine may be equipped with an electric starting and lighting outfit and of course cooperates from an ordinary drum by means of a vacuum tank and flexible tubing. The engine may be supplied with or without a radiator.

Simplex Pipe Pushing Jacks

Pipe jacks fill a definite want in the waterworks field. The simpler the unit the better. Templeton, Kenly & Co., Ltd., 1020 So. Central Avenue, Chicago, are marketing a jack made in two sizes. The No. 332 jack handles pipe ¾ in., 1 in., 1¼ in., 1½ in., and 2 in. in diameter.

Weight of jack complete .....198 lb.

Weight of jack without equipment.....146 lb.

Equipment consists of one set of tapered jaws, steel lever bars and extension pipes.

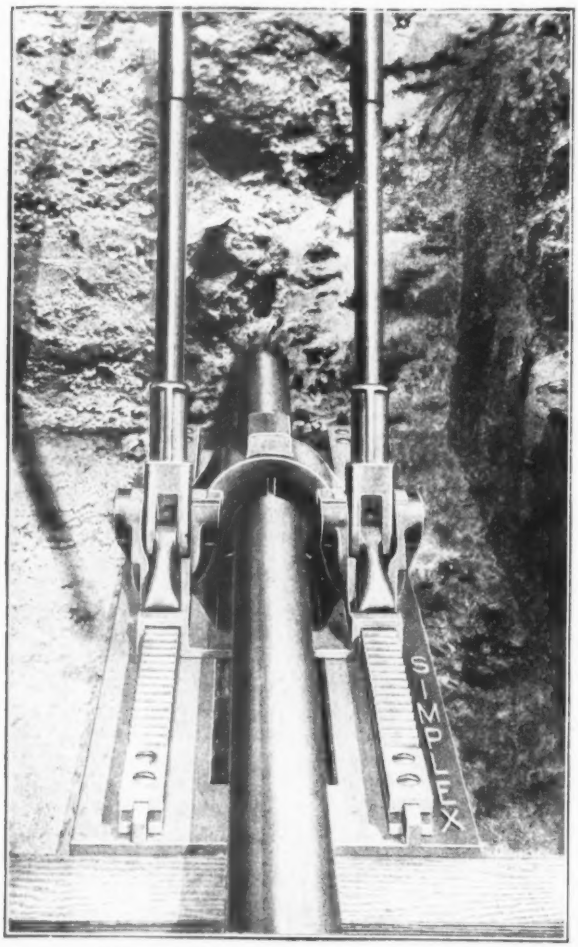
The No. 334 jack handles pipe 2 in., 2½ in., 3 in., and 4 in. in diameter.

Weight of jack complete .....395 lb.

Weight of jack without equipment.....212 lb.

Equipment consists of one set of tapered jaws, steel lever bars and extension pipes.

Both machines have a 25 in. travel and the time required for pushing pipe 25 in. and resetting, it is claimed, averages five to six minutes. The design of the tapered jaws insures the complete surrounding or gripping of the pipe whereby kinks or flattening of the pipe is overcome.

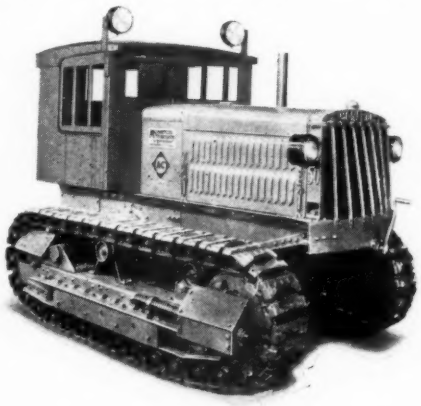


Simplex Jack Pushing Section of 3-in. Pipe

Allis-Chalmers-Monarch Announce Models for Winter Work

The Allis-Chalmers-Monarch "50" and "75" tractors have been equipped for winter work, with fully enclosed weatherproof cabs, constructed to keep the operator warm in the most inclement weather conditions. Full vision glass panes offer maximum visibility. Cabs on both models are roomy, providing comfort for the operator. Special easy detachable and self-cleaning ice and snow grousers, it is claimed, assure positive traction for snow removal and winter logging work. Tracks with grousers cast integral can also be furnished.

These models having great reserve power are especially adapted to snow removal work. Various makes of heavy "V" type and rotary plows are easily attached. This is a desirable combination in removing the snow blockade quickly and surely.



Allis-Chalmers-Monarch Equipped for Winter Work

Snow blockades cost the United States and Canada hundreds of millions of dollars annually. They tie up commerce, increase manufacturing and transportation costs, damage road and highway surfaces, increase fire hazards, delay mail service, and cause endless inconveniences. Every year the terrific toll exacted by snow blockades is felt by hundreds of thousands of people in every walk of life, by every city, large and small. Everywhere, taxpayers and public officials are awakening to the realization that their roads must be kept clear—that their concrete highways which cost them approximately $30,000 per mile of their own money must receive the best winter protection that can be procured. Protection against the wastes of snow blockade means only one thing—efficient, dependable snow removal.

Complete details of the above models can be obtained by writing for the booklet, "The Removal of Snow," to Monarch Tractors Corporation, Springfield, Ill.

The New "American" Sump Pumps

The American Well Works has just announced a new and improved line of sump pumps having many advantages over the old type. This new line, besides being self-controlled, is claimed to be highly efficient and sturdily built to meet the unusual in service and to stand up under abuse.

The "American" type M. M. D. sump pump differs from other motor-driven pumps in that it employs a hollow shaft motor in place of the old solid shaft type. This construction makes possible a simple compact pump. By this construction, flexible couplings and thrust bearings are eliminated. The pump shaft extends up through the motor shaft, hence both motor and pump use the same thrust bearing which is mounted in the upper end of the motor, making adjustments very easily.

The elimination of high motor supports is made possible as the pump supporting pipe is bolted through to a cast iron plate that in turn bolts to the motor. Regardless of distortion in the pit cover, the alignment of the pump and motor is not affected.

The pump shaft bearings consist of removable bushings. The pit plate is made of plate steel and is furnished either round or square. Pump may be had for all standard settings up to 17 ft. in either single or duplex units.

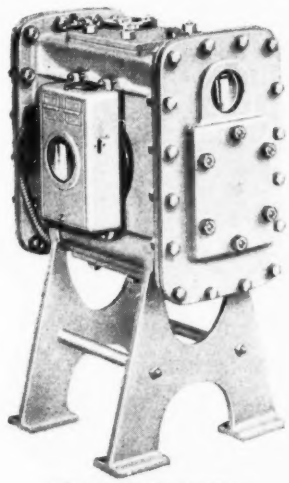
All units are furnished complete with float control switch, oiling device and motor.

The American Well Works has published complete specifications and catalogs covering this new type pump, which will be sent to anyone interested without obligation.

Type M.M.D. Sump Pump

Ultra-Violet Ray Water Sterilizer

A small piece of equipment for sterilizing water by the employment of ultra-violet rays is announced by James B. Clow and Sons, P. O. Box N. N., Chicago, Ill. Sterilization under the R.-U.-V. patents applies to water supply of swimming pools, drinking water, bottled beverages, and steamship drinking water. Operating cost is very low; the system is simple. Sterilization is positive, because infallibility of attendant is not essential.



The R.-U.-V. Sterilizer

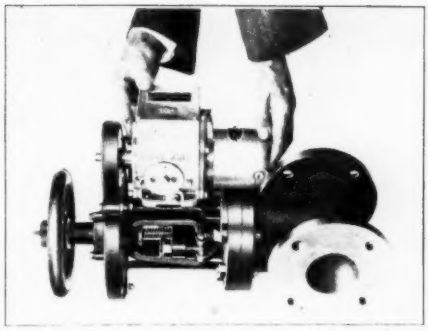
During the convention of the American Public Health Association in Chicago in October a private demonstration of R.-U.-V. was arranged by Dr. Kegel, health commissioner of Chicago, which aroused considerable interest among the public health officials present.

New Motor Driven Mechanism for Operating Valves

A new motor driven valve operating unit has just been announced by the Cutler-Hammer Mfg. Co., Milwaukee, Wis., which makes possible automatic operation of all valves up to 6 in.

Although so small that it can be held in one hand, this unique operating unit has a rating of 15 lb. ft. It can be operated automatically by means of float switches, temperature controlling devices, pressure regulators, etc., or by conveniently located push buttons.

Although only recently placed on the market this valve operating unit is similar in principle to the standard C-H "Dean" operating unit which has a successful record of 12 years.



New Motor Driven Valve Operating Mechanism

While designed primarily for valve operating service in industries where regulation of pressures and temperatures of gases and fluids is necessary, it is likewise adaptable to many miscellaneous applications.

Literature describing this new unit (called C-H type Ao Valve Operating Unit) will be sent free, upon request to the Cutler-Hammer Mfg. Co., 1298 St. Paul Ave., Milwaukee, Wis.

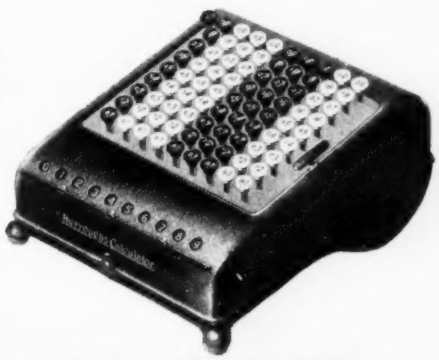
Burroughs Electric Calculator

An electrically operated calculator is being introduced by Burroughs Adding Machine Company.

The electric operation, it is claimed, reduces the actual physical effort on the part of the operator to a short depression of the keys. The light key touch, which is uniform for all keys, actuates the motor and the motor instantly completes the operation. This new key touch with the motor doing the work, results, the company states, in greater operating efficiency and greater production per operator.

Another advantage claimed for the new Burroughs machine is positive key action. Errors due to incomplete strokes of the keys are impossible, the company states, as the operator cannot short-stroke or otherwise misoperate a key.

The new calculator is similar in size and appearance to other Burroughs machines of this type. The small motor



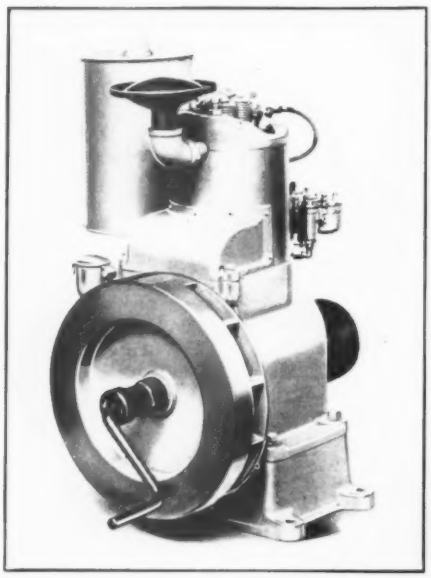
Burroughs New Electric Calculator

is entirely enclosed within the case and operates on alternating or direct current. It runs only when a key is depressed.

The new calculator, in ten-column totaling capacity size, is being shown in Burroughs offices throughout the country and deliveries are being made. Production of the new machine is being increased steadily, the company states, so that within a short time immediate deliveries can be made.

New Vertical Air-Cooled Engine Announced

The Lauson, vertical air-cooled engine, fills the increasing demand for a motor built on automotive lines, but not too heavy in weight, and with working parts substantial enough to give continuous service. Neat, compact, self-contained construction makes it readily



Showing New Vertical Air-Cooled Engine

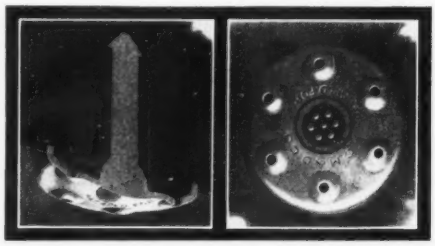
applicable to portable units. It also meets the demand of stationary power users for a motor of the higher class design that can be installed on water or light units in a power house or wherever smooth, quiet operation coupled with cleanliness is appreciated.

Specifications

Number of cylinders	1
Bore	2¾ in.
Stroke	3¼ in.
Cycle	4
Speed	900 to 1,400 r.p.m.
Horsepower	1½ at 1,200 r.p.m.
Ignition	Wico type B magneto
Fuel	Gasoline
Carburetor	Tillotson
Flywheel diameter	12 in.
Flywheel face	2¾ in.
Crankshaft bearings	1⅜ in.
Crank pin	1¼ in.
Governor	vertical flywheel type, gear driven, enclosed in dustproof housing, speed adjustable
Height over all	24½ in.
Width over all	21⅜ in.
Pulley	4⅝ in. diam., 3 in. face, fibre
Net weight	170 lb.
Domestic shipping weight	200 lb.
Export shipping weight	260 lb.
Boxed for export	10 in. x 19 in. x 30 in.

Non-Slip Street Buttons

Advantages of the small metal unit for marking street car loading zones and traffic lanes have been generally accepted. They seem to have a long life, can be installed with speed and without much effort, and can be placed



Cross-Section and Top View of Non-Slip Street Button

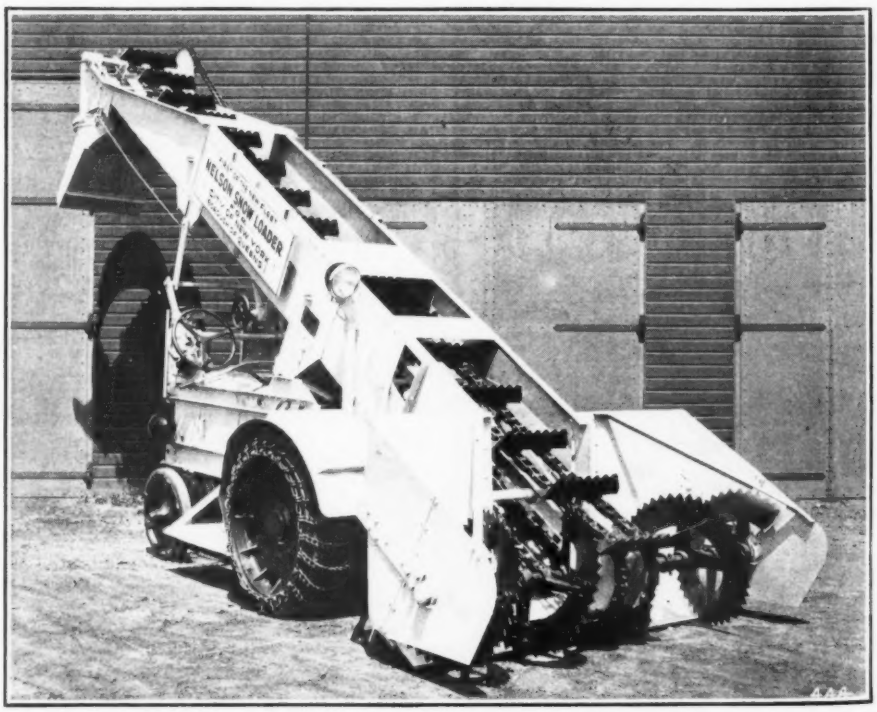
in practically every type of pavement without resurfacing or danger of damage to the surrounding pavement. The one disadvantage of the types now in use is that their smooth, shiny tops, sometimes cause pedestrians to slip on them, especially in rainy weather, or during snow or sleet storms.

To get around this, a new type of button with a perforated top has been developed. These buttons are constructed from a piece of heavy "stainless" iron plate into the center of which is upset a substantial anchor bolt. The tops of these buttons are crowned with a number of raised vacuum cups placed around the outside rim bringing it back to a horizontal plane. The edges of the button are turned down and enter into the pavement, to give a wide base and prevent it from working itself down into soft pavements. This feature is also intended to prevent the button from being torn out by snow plows or scrapers.

Further information may be obtained from the manufacturers, The Chicago Manufacturing & Distributing Company, 4010 S. Wells St., Chicago, Ill.

New Snow Loader

The latest model of the snow loader of the N. P. Nelson Iron Works, Inc., Passaic, N. J., is illustrated herewith. The machine takes its power from a 35 hp. Hercules engine. This drives the conveyor and feeder and is connected through the clutch and transmission to the worm gear differential. Heavy chain and sprocket drives extend from the differential axles to the lock shafts and tractor wheels. The lock shafts, which are an essential part of the Nelson transmission, carry a manually controlled clutch which, when engaged, makes both traction wheels move at the same speed. If slippery pavements cause one wheel to spin, thereby destroying the tractive power, the push of a handle locks both transmission wheels together and compels both to work. All wheels are on Timken roller bearings. The loader has eight speeds, three forward and one reverse, in the high-speed group, and three reverse or digging speeds and one forward or pull-out speed on the low speed group. The speed range is from 8 miles per hour in high, down to 30 ft. per minute for digging. The loader has three independent sets of brakes.



New Nelson Type R-5 Special Snow Loader Owned by City of New York